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PHILOSOPHICAL,

MEDICAL, AND EXPERIMENTAL

ESSAYS.

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PHILOSOPHICAL, MEDICAL, AND EXPERIMENTAL ESSAYS;

VIZ.

I. On the State of Population in MANCHESTER, and other adjacent Places.
II. On the proportional Mortality of the SMALL POX and MEASLES, in the ſeveral Periods of Life, and different Seaſons of the Year; together with its comparative Fatality to Males and Females.
III. On the different Quantities of RAIN which fall, at different Heights, over the ſame Spot of Ground.
IV. On the Solution of STONES of the URINARY and of the GALL BLADDER, by Water impregnated with Fixed Air.
V. On the Nature and Compoſition of URINARY CALCULI.
VI. On the Internal Regulation of HOSPITALS.
VII. On the Influence of FIXED AIR on the Colours and Vegetation of PLANTS.
VIII. On the Action of different MANURES.
IX. On the Properties of different ABSORBENTS.
X. Miſcellaneous OBSERVATIONS, CASES, and INQUIRIES.

By THOMAS PERCIVAL, M.D.

Fellow of the ROYAL SOCIETY, and of the SOCIETY of ANTIQUARIES in LONDON.

TO WHICH IS ADDED AN

APPENDIX;

CONTAINING A
LETTER TO THE AUTHOR FROM DR. SAUNDERS,
ON THE SOLUTION OF HUMAN CALCULI;
WITH OTHER PAPERS.

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THE RIGHT HONOURABLE

WILLIAM

EARL OF SHELBURNE,

VISCOUNT FITZ-MAURICE,

AND

BARON WYCOMBE;

ONE OF HIS MAJESTY'S MOST HONOURABLE
PRIVY COUNCIL;

AND

L L. D.

&c. &c.

MY LORD,

THE rapid progreſs of Science, in this age of free inquiry, is a ſubject of gratitude and exultation to every wiſe and good man. Human nature ſeems to have riſen in the great ſcale of being; and the mind, exalted with its intellectual and moral acquiſitions, labours ſtill to aſcend; aſpiring to higher and higher degrees of perfection. The Philoſopher contemplates, with heartfelt ſatisfaction, this glorious pre-eminence. He venerates the dignity of the human character; and diſdains whatever tends to the degradation or debaſement of his ſpecies. This generous enthuſiaſm kindles in his breaſt the ſacred flame of Liberty: He loves his country, but regards himſelf as a citizen of the world; and vindicates the equal and unalienable rights of all mankind.

Such, my Lord, are the principles of genuine patriotiſm; and how animating their influence is, I appeal to the feelings of your own heart, and to the uniform tenour of your public and private conduct! As a SENATOR, you have maintained, with intrepidity and zeal, thoſe liberal maxims of Government, on which the Revolution was founded, and to which we owe the elevation of the Houſe of Hanover to the ſovereignty of theſe dominions: Illuſtrious events, which will for ever diſplay the ſpirit and magnanimity of the PEOPLE of England!

As a Nobleman, you are entitled to the diſtinguiſhed praiſe of being a promoter of the uſeful and ornamental arts; a friend to commerce; and a beneficent patron of learning. Theſe, my Lord, are the ſuperior privileges of an ample fortune and elevated rank; and happy ſhould I be, were it in my power to weave an unfading garland of honour, for one ſo meritorious in the application of them. But this I preſume not to attempt; ſatiſfied with the pleaſing opportunity which I now enjoy, of expreſſing the perfect eſteem, and affectionate regard, with which I have the honour to be,

MY LORD,

Your Lordſhip's

moſt faithful, obliged,

and obedient Servant,

MANCHESTER,
Feb. 6th, 1776.

THOMAS PERCIVAL.

THE

PREFACE.

IN the Preface to a former volume, publiſhed about three years ago, I availed myſelf of the authority of the great Lord Bacon; whoſe plan I have ſteadily purſued in the collection and arrangement of FACTS, OBSERVATIONS, and EXPERIMENTS. Long and ſyſtematic compoſitions are neither compatible with the extenſive engagements of my profeſſion; nor with the attention which is due from me to a dear and numerous family. But in this deſultory way, I can employ a vacant hour; beguile the diſtance of a tedious journey; or divert the anxieties of a feeling heart, with improvement to myſelf, and, I am willing to hope, with advantage to others. The indulgence, with which I have hitherto been honoured by the public, may, at leaſt, be pleaded as an apology for this ſelf-flattery.

To Men of Letters, the mode of writing in detached Eſſays is commonly agreeable; becauſe it precludes the labour of reading or of repeating elementary propoſitions, and well-known truths; it renders the detection of error more eaſy; facilitates the communication of new diſcoveries; and preſents to the mind, in ſeparate and diſtinct views, the additions which are made to the general ſtock of knowledge.

Several of the following Tracts and Miſcellaneous Obſervations have before appeared in the Philoſophical Tranſactions, and in other publications. As they were favourably received, I have reviſed, enlarged, and inſerted them in this volume.

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OBSERVATIONS
ON THE
STATE OF POPULATION
IN
MANCHESTER,
AND OTHER ADJACENT
PLACES.

OBSERVATIONS
ON THE
STATE OF POPULATION
IN
MANCHESTER,
AND OTHER ADJACENT PLACES.

FROM an account taken in 1717, the number of inhabitants in Mancheſter, for I am uncertain whether Salford (*a*) was included, appears to have been 8000.

By

(*a*) MANCHESTER and Salford, though diſtinguiſhed by different names, like London, Weſtminſter, and the Borough of Southwark, may be conſidered as one and the ſame town, being divided only by a ſmall river, over which two bridges are erected.

By a ſurvey made in 1757 of Mancheſter and Salford, the number of inhabitants was found to be 19839. And from 1754 to 1761 incluſive, the number of deaths amounted to 5769. The annual deaths therefore, at the period of the ſurvey, muſt have been 721, excluſive of diſſenters. It is probable, as will appear afterwards, that theſe would have increaſed the number to 771. At this time therefore 1 in 25 .7 of the inhabitants of Mancheſter died every year.

A new ſurvey of Mancheſter has been executed this ſummer (1773) with great care and accuracy, of which the following is a particular account.

MANCHESTER.		SALFORD.
3402	Houſes	866.
5317	Families	1099.
10548	Males	2248.
11933	Females	2517.
7724	Married	1775.

MANCHESTER.		SALFORD.
432	Widowers	89.
1064	Widows	149.
7782	Under 15	1793.
3252	Above 50	640.
342	Male Lodgers	18.
150	Female Do.	13.
44	Empty Houſes	26.

FROM hence it appears that the number of tenanted houſes in Mancheſter and Salford amounts to 4268; the families to 6416; and the inhabitants to 27,246. The proportion of perſons to a houſe therefore is more than 6⅓; and of individuals to a family about 4¼. The females exceed the males by 1654; the widows are more than double the number of widowers; and about a ſeventh part of the inhabitants have attained the age of fifty.

THE following Table is formed from the Regiſter of Burials and Baptiſms at the Collegiate or Pariſh Church in Mancheſter, and gives the annual number of each on an average.

			Burials.	Baptiſms.
From	1580	to 1587 incluſive,	184	
	1680	1687	286	
	1720	1727	359	
	1754	1760	736	769
	1761	1765	731	843
	1766	1770	870	970

BUT it ſhould be remarked that this account does not include the Deaths or Births amongſt the Diſſenters. Theſe, by a late improvement in our Bills of Mortality, are now received into the Pariſh Regiſter; and laſt year (1772) the former amounted to 50, the latter to 181. Admitting theſe to be the average of unregiſtered Baptiſms and Burials in Mancheſter, the annual medium of Deaths from 1768 to 1772 incluſive, will be 958. And the annual Births during the ſame period, with the like allowance, will be 1098. Hence the preſent proportion of annual Deaths to the Inhabitants is nearly as 1 to 28 .4; and of Births to the Inhabitants almoſt as 1 to 25. The Births alſo, it appears, exceed the Burials 140 every year at a medium.

The rapid growth of Mancheſter is ſufficiently evident from the preceding facts. Yet Leverpool, during the ſame ſpace of time, has increaſed in a much greater proportion. This appears from the following Table, which I have extracted from a very curious and entertaining work, lately publiſhed by my ingenious friend the Rev. Dr. Enfield, Lecturer on the Belles Lettres in the Academy at Warrington.

(b) Year.	Number of Inhabitants.	Annual Addition.
1700	5714	
1710	8168	245
1720	10446	227
1730	12074	162
1740	18086	601
1750	22099	401
1760	25787	368
1770	34004	822

According to this Table, Leverpool has at preſent upwards of ſix times the number of inhabitants which it contained at the beginning of this century.

But the progreſs of trade and opulence in Mancheſter has been more than adequate to its advancement in population. For a conſiderable part of the manufactury of this flouriſhing town, is carried on in the adjacent country, which is thereby crouded with houſes and inhabitants.

(b) Hiſtory of Leverpool, page 28, ſecond edition, corrected.

bitants. So populous are the Environs of Mancheſter, that every houſe in the townſhip has been found, by a late ſurvey, to contain at an average ſix perſons. The townſhip is indeed but of ſmall extent; and the greateſt part of it will probably, in a ſhort time, be included in Mancheſter. It contains 311 houſes; 361 families; 947 males; 958 females; 656 married perſons; 21 widowers; 42 widows; 763 under 15 years of age; and 222 above 50.

It is pleaſing to obſerve, that notwithſtanding the enlargement of Mancheſter, there has been a ſenſible improvement in the healthineſs and longevity of its inhabitants; for the proportion of Deaths is now conſiderably leſs than in 1757. But this is chiefly to be aſcribed, as Dr. Price has juſtly obſerved *(c)*, to the large acceſſion of new ſettlers

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(c) See a moſt valuable Treatiſe on Reverſionary Payments, page 188, third edition.

ſettlers from the country. For as theſe uſually come in the prime of life, they muſt raiſe the proportion of *inhabitants* to the *deaths*, and alſo of *births* and *weddings* to the *burials*, higher than they would otherwiſe be. However, excluſive of this conſideration, there is good reaſon to believe that Mancheſter is more healthy now than formerly. The new ſtreets are wide and ſpacious, the poor have larger and more commodious dwellings, and the increaſe of trade affords them better cloathing and diet than they before enjoyed. I may add too, that the late improvements in medicine have been highly favourable to the preſervation of life. The cool regimen in fevers, and in the ſmall pox; the free admiſſion of air; attention to cleanlineſs; and the general uſe of antiſeptic remedies and diet, have certainly mitigated the violence, and leſſened the mortality of ſome of the moſt dangerous and malignant diſtempers to which mankind are incident.

dent. The Ulcerous Sore Throat, which prevailed here in the year 1770, is the only epidemic which has appeared in Mancheſter with any fatal degree of violence, for many years. Miliary Fevers, which were formerly frequent in this town and neighbourhood, now rarely occur; and if I may judge from my own experience, the natural Small Pox (for Inoculation is not much practiſed here) carries off a much ſmaller proportion of thoſe who are attacked by it, than is commonly ſuppoſed. Puerperal diſeaſes alſo decreaſe every year amongſt us, by the judicious method of treating women in child-bed: and as nature is now more conſulted in the management of infants, it is reaſonable to ſuppoſe that this muſt be favourable to their health and preſervation.

But it muſt be acknowledged that large towns are injurious to population; and the advantages I have enumerated, which in hamlets or country villages would have operated with full force to the benefit of mankind, have only ſerved to check the deſtructive tendency of the accumulation of inhabitants in Mancheſter. In the Pais de Vaud, a diſtrict of the province of Bern in Switzerland, and in a country pariſh in Brandenburgh, 1 in 45 of the inhabitants die annually; and at Stoke Damarell in Devonſhire, 1 in 54 (d): whereas in this town the yearly mortality appears to be 1 in 28; in Leverpool 1 in 27; and in London 1 in 21. Half the children who are born in Mancheſter die under five years old; and the proportion which the births bear to the number of inhabitants who attain the age of 80, is as 30 to 1. Diſeaſes are moſt frequent and fatal here in the months of January, February, and March; and leaſt ſo in July, Auguſt, and September.

(d) See the Treatiſe before referred to, on Reverſionary Payments, by my learned friend Dr. Price.

tember. The mortality of theſe two ſeaſons is as 11 to 8; and of the firſt ſix months of the year compared with the laſt ſix months, as 7 to 6.

In April, 1773, ſeveral Gentlemen, from motives of curioſity, undertook an enumeration of the people of Bolton, a manufacturing town about twelve miles diſtant from Mancheſter. The houſes were found to be 946; the males 2159; the females 2392; and perſons aged ſeventy years and upwards, 74. To theſe numbers 17 muſt be added, which by a miſtake were not claſſed under either denomination. The inhabitants of Bolton therefore amount to 4568; the number of individuals to a houſe is 4.8; and about a ſixtieth part of the people have attained the age of ſeventy.

Little Bolton, a ſuburb of Bolton, including the manor, and extending into the country as far as the inhabitants are ſubject to *ſuit* and *ſervice*, contains 232 houſes; 771 individuals; 361 males; 410 females; and 15 perſons aged ſeventy years and upwards. From this account it appears that the inhabitants are 3 .3 to a houſe; and that 1 in 51 has reached the age of ſeventy. The difference in theſe proportions between a ſmall *town*, and a *country manor* contiguous to it, is worthy of obſervation.

Mr. Fletcher has favoured me with an enumeration of the people of Bury, which he has juſt executed with great care. The town contains 463 houſes; 464 families; and 2090 inhabitants. Each houſe and family therefore conſiſts of 4½ individuals. Bury is ſituated nine miles from Mancheſter, and is enriched by a branch of the woollen manufactury.

At Altringham, a market town in Cheſhire, which has no manufactury, the number of houſes, according to an exact ſurvey made in July, 1772, was 248; of inhabitants 1029, or 4$\frac{1}{7}$ to a houſe. An enumeration of the people of this town was made about twenty years ago, at which time they amounted very nearly to 1000.

The following is a comparative view of the ſtate of population, the duration of life, and the mortality of the ſeveral ſeaſons of the year, &c. in Eastham, and Royton, two country places widely different from each other in climate, ſituation, and in the occupation of their inhabitants.

The pariſh of Eaſtham lies in Wirral, one of the hundreds into which Cheſhire is divided, and is extended along the banks of the river Merſey, a few miles diſtant from the Iriſh ſea. The people are moſt of them farmers; though ſome are fiſhermen, and others are employed in the ferry to Leverpool.

ROYTON is a chapelry, ſituated ten miles eaſtward of Mancheſter, under the great chain of mountains which divides Lancaſhire and Yorkſhire. The inhabitants are employed chiefly in the cotton and linen manufactury; a few of them are farmers; and ſome I believe work in the coal pits, with which this country abounds.

I AM indebted to my learned friend the Rev. Mr. Travis, Vicar of Eaſtham, for the ſurvey of his own pariſh, which he undertook at my deſire, and executed himſelf; and alſo for that of Royton, which was made by his uncle, the worthy and reſpectable Clergyman of that Chapelry.

JANUARY 1ſt, 1772, the number of inhabitants in the chapelry of Royton were found to be 1105.

The number of inhabitants in the pariſh of Eaſtham, 912.

The number of perſons *in a houſe*, in the chapelry of Royton is ſomewhat more than - - - $5\frac{1}{7}$.
The number of ditto, - in the pariſh of Eaſtham, - - - exactly - 5.
The number of perſons *in a family*, in the former on an average, - - - about - $4\frac{3}{4}$.
The number of ditto, - in the latter, - - - - more than - $4\frac{1}{2}$.
The proportion of males to females, in Royton, - - - - nearly as - 53 to 56.
The proportion of ditto, - in Eaſtham, - - - - nearly as $54\frac{1}{2}$ to 56.
The widows to the widowers, in Royton, - - - - - as - $3\frac{1}{3}$ to 1.
The widows ditto, - in Eaſtham, - - - - - as - 3 to $2\frac{1}{2}$.
The number of births in Royton (on an average of 3 years) 42. } Proportion between males and females as 13 to 11.
The number of do. in Eaſtham - do. - 34. } Proportion between ditto, - as 18 to 16.

N. B. Theſe proportions for 7 years.

The number of births in Royton to the number of married inhabitants, as (very nearly) 1 child to 5 married couples.
The number of do. in Eaſtham to ditto, - - as (ſomewhat more than) 1 child to 4 married couples.
The number of births in Royton to the whole number of inhabitants, - as - - 1 to $26\frac{1}{3}$.
The number of do. in Eaſtham to ditto, - - - - as - - 1 to $26\frac{4}{5}$.
The number of married perſons in Royton to the number of unmarried perſons above 15, - as - 8 to 5.
The number of ditto, - in Eaſtham to the number of - ditto, - ditto, nearly as 6 to 5.

The number of burials in Royton (on an average of 3 years) 21. } Proportion between males and females as 13 to 10.
The number of ditto in Eaſtham - ditto - 26. } Proportion between - ditto - as 14 to 12.

The number of burials in Royton to the number of all the inhabitants, - as - 1 to 52.

The number of ditto in Eaſtham to - ditto, - - - - as - 1 to 35.

The number of children dying under 3 yrs. old to the number of children born in Royton (on an average of 3 yrs.) as 1 to 7.

The number of children - ditto - to - ditto - in Eaſtham - - as 1 to 17.

Perſons alive in Royton under 3 years old Jan. 1. 1772, 129; dead under 3 years old, average of 3 years, 6, or 1 of 21 $\frac{1}{2}$.

Ditto in Eaſtham - - - - 100; - - - - - dead 2, or 1 of 50.

Perſons alive in Royton under 15 years old Jan. 1. 1772, 450; dead under 15 years old, average of 3 years, 11, or 1 of 41.

Ditto in Eaſtham - - - - 329; - - - dead 4, or 1 of 82.

Perſons alive in Royton between 15 and 30 years old Jan. 1. 1772, 333; dead before 1773 of theſe 5, or 1 of 66$\frac{1}{2}$.

Ditto in Eaſtham - - - - 199; - - dead 5, or 1 of 40.

Perſons alive in Royton from 30 to 40 years old ditto, 96; dead before 1773 of theſe on an average, 2, or 1 of 48.

Ditto in Eaſtham - - - 124; - - - dead 4, or 1 of 31.

Perſons alive in Royton from 40 to 50 years old ditto, 98; dead before 1773 of theſe on an average, 2, or 1 of 49.

Ditto in Eaſtham - - - 83; dead before 1773 of theſe - 3, or 1 of 28.

Perſons alive in Royton from 50 to 60 years old ditto, 61; dead before 1773 of theſe - 1$\frac{1}{3}$, or 1 of 45.

Ditto in Eaſtham - - - 64; dead before 1773 of theſe - 2, or 1 of 32.

Perſons alive in Royton from 60 to 70 years old ditto,	49;	dead before 1773 of theſe -	$1\frac{1}{3}$, or 1 of 36.	
Ditto in Eaſtham - - -	54;	dead before 1773 of theſe -	$1\frac{1}{3}$, or 1 of 40.	
Perſons alive in Royton from 70 to 80, Jan. 1. 1772, 10 80 to 90, ditto, 8	above 70 years, 18	dead before 1773, on an average of 3 years,	1 of 18.	
Perſons alive in Eaſtham from 70 to 80, ditto, 34 80 to 90, ditto, 5	above 70 years, 39	dead before 1773, on an average of 3 years,	1 of 21.	(e)

The mortality of the ſeaſons at Royton and Eaſtham, for the laſt ſeven years, has been as follows:

			ROYTON.	EASTHAM.
January,	February,	March,	39	56
April,	May,	June,	31	34
July,	Auguſt,	September,	31	45
October,	November,	December,	18	53
			119	188

(e) The averages here adopted may, in ſome inſtances, ſeem to be too ſmall; but Mr. Travis aſſures me, that through a ſeries of fifteen ſucceſſive years, the Marriages, Births, and Deaths at Eaſtham, do not vary, in any degree worth remarking, from the foregoing Table.

Of all the months in the year ſingly taken, October is the moſt, and April the leaſt fatal to the inhabitants of Eaſtham. Whereas the three laſt months of the year appear to be the moſt healthful at Royton; although a very large quantity of rain uſually falls there during this ſeaſon. For the wind at this time being generally weſterly, the clouds are intercepted by the high mountains, and diſcharge themſelves in frequent and heavy ſhowers. At Townley, which is ſituated under the ſame chain of hills, and is not very far diſtant from Royton, 42 inches of rain fall at a medium, every year. The quantity of rain at Mancheſter, which is farther removed from the mountains, is about 33 inches *communibus annis*. It has been obſerved by a very uſeful writer, that the *moiſt ſeaſons* in Great Britain and Ireland are more remarkably free from epidemic diſeaſes, than the dry ones; and that ſtorms, the uſual concomitants of rain, are attended with more health and leſs ſickneſs than calm weather, probably becauſe they diſſipate the vapours, which by ſtagnation might prove an occaſion of various diſtempers (f). I ſhall not preſume to determine that theſe obſervations account for the ſuperior healthineſs of the laſt months of the year at Royton; but they certainly ſhould remove the prejudice which is too generally entertained againſt the wetneſs of the climate in Lancaſhire, and other weſtern counties of England. For the bounties of Providence are diſpenſed with an equal, as well as with a liberal hand. And if we, in this part of the iſland, enjoy leſs ſunſhine than our neighbours, we have milder winters, and ſummers tempered with more refreſhing ſhowers, to balance the inconvenience.

THE Rev. Mr. Bolton, a very worthy diſſenting Clergyman at MONTON, a few miles from Mancheſter, has at my requeſt, made an enumeration of his people, with a retroſpective view of the births and deaths amongſt them during the laſt ten years. By this ſurvey, his congregation, including ſervants, conſiſts of 196 males; 190 females; 97 families; 60 married perſons; 14 widowers; 13 widows; 142 under 15 years of age; and 64 above 50. The deaths during ten years have been 57, and the births 138. Hence it appears, that of this ſociety 1 in 6 has attained the age of 50; that the births are more than double the burials; and that only 1 in 68, at a medium, dies every year. The laſt circumſtance is ſomewhat extraordinary; but to remove all doubts concerning the accuracy of his enumeration, Mr. Bolton, with the moſt obliging aſſiduity, has repeated it twice. And he has derived his information not only from the regiſter of his chapel, but alſo from the private records, or deliberate recollection of every family in his congregation. The *ſituation* of Monton appears to be rather unfavourable to health, from the vicinity of a large moſs; but the people are moſt of them farmers, and are remarkable for their diligence and ſobriety. The long life which they enjoy affords a ſtriking and pleaſing proof of the great advantages of temperance; and confirms a curious obſervation of M. Muret, who examined the regiſter of mortality in one town, to mark thoſe whoſe deaths might be imputed to *exceſs*. The number of theſe he found ſo great, as led him to believe that *drunkenneſs* is more deſtructive to mankind than pleuriſies, fevers, or the moſt malignant diſtempers.

(f) Rutty's Chronological Hiſtory of Weather.

Aug. 16th, 1773.

FURTHER OBSERVATIONS ON THE STATE OF POPULATION IN MANCHESTER,

AND OTHER ADJACENT PLACES.

THE number of inhabitants and progreſs of population in the kingdom; the increaſe or decreaſe of certain diſeaſes; the comparative healthineſs of different ſituations, climates, and ſeaſons; and the influence of particular trades and manufactures on the duration of life, are ſubjects of the higheſt

eſt importance to the community; and equally intereſting to the ſtateſman, the philoſopher, and the phyſician.

"I HAVE ſomewhere read," ſays Dr. Franklin (in the remarks on my former paper with which he has lately favoured me) "that in China an account is yearly taken of the number of people, and "the quantities of proviſion produced. "This account is tranſmitted to the "Emperor, whoſe miniſters can thence "foreſee a ſcarcity likely to happen in "any province, and from what province "it can beſt be ſupplied in good time (a). "To facilitate the collecting of this account, and prevent the neceſſity of "entering houſes and ſpending time in "aſking and anſwering queſtions, each "houſe is furniſhed with a little board "to be hung without the door during a "certain time each year; on which

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(a) CHINA, like all other countries that ſubſiſt chiefly upon rice, is ſubject to frequent famines. *Monteſquieu.*

" board are marked certain words, againſt " which the inhabitant is to mark number or quantity, ſomewhat in this " manner :

Men
Women
Children
Rice or Wheat
Fleſh, &c.

" All under 16 are accounted children, and all above, men and women. " Any other particulars which the government deſires information of are " occaſionally marked on the ſame " boards. Thus the officers appointed " to collect the accounts in each diſtrict, " have only to paſs before the doors, and " enter into their book what they find " marked on the board, without giving " the leaſt trouble to the family. There "is a penalty on marking falſely; and as "neighbours muſt know nearly the truth "of each other's account, they dare not "expoſe themſelves by a falſe one, to "each other's accuſation. Perhaps ſuch "a regulation is ſcarcely practicable with "us."

But an enumeration of the people of England, ſimilar to that lately executed at Mancheſter, would not be ſo difficult an undertaking, as may at the firſt view be imagined. And if accurate and comprehenſive Bills of Mortality were univerſally eſtabliſhed, they would admirably coincide with the views of ſuch inquiries, and give preciſion and certainty to the concluſions deduced from them (b).

(b) Vid. The author's Propoſals for eſtabliſhing accurate Bills of Mortality in Mancheſter. Eſſays Medical and Experimental, Vol. 2. Theſe Propoſals have been adopted, and with a few variations carried into execution by Dr. Haygarth at Cheſter, Dr. Dobſon at Leverpool, and by Mr. John Aikin at Warrington.

From the populouſneſs of this neighbourhood, it may perhaps be ſuppoſed, that a great number of burials are brought from the Country to the Collegiate and other Churches in Mancheſter, and that this circumſtance is likely to create uncertainty and error in the calculations made from the parochial regiſter of deaths. But it appears from the beſt information I can collect, that the number of ſuch burials is not conſiderable; and that they are pretty exactly balanced by thoſe which are carried out of Mancheſter to the neighbouring epiſcopal or diſſenting chapels. This fact admits of an eaſy and ſatisfactory explanation, were it neceſſary to trouble the reader with it.

It is remarked in the former paper that wet ſeaſons are generally more free from epidemic diſeaſes than dry ones, and the Bills of Mortality at Mancheſter *ſeem* to confirm the obſervation: It appears at leaſt from the following table, that the year 1766, remarkable in this climate for the ſmall quantity of rain which fell during the courſe of it, was more fatal than any of the reſt. And the proportion of deaths will be deemed greater when it is recollected, that the town contained at that time fewer inhabitants (probably two thouſand) than it does at preſent. For the rapid increaſe of Mancheſter commenced about the year 1765, after the concluſion of the laſt war.

Year.	Quantity of Rain at Mancheſter. Inches.	Deaths at Mancheſter.
1765	31. 378	723
1766	25. 762	1019
1767	29. 186	690
1768	40. 526	867
1769	32. 514	788
1770	39. 363	988
1771 from Jan. 1. to June 1.	6. 8 (c)	

(c) THIS account of the quantity of rain, was communicated to me by George Lloyd, Eſq. F. R. S. The obſerva-

This table, it muſt be acknowledged, does not comprehend a ſufficient length of time to admit of any very accurate or incontrovertible concluſions from it. And the influence of other cauſes of diſeaſe, which have little or no relation to the ſtate of the atmoſphere, together with the irregularity which neceſſarily occurs in the annual increaſe of a large manufacturing town, may be regarded as further ſources of fallacy and uncertainty. It is therefore with diffidence I obſerve, that though wet ſeaſons are leſs mortal than long continued droughts, yet the rainy years 1768 and 1770 proved extremely ſickly and fatal. And thoſe years are probably moſt unfavourable to health, in which heavy rains fall about the beginning of ſummer, and are

obſervations were made (upon the ground) at his ſeat, about a mile diſtant from the center of Mancheſter, and were continued only till June 1771. The ſituation of my own houſe, and my frequent and diſtant calls into the country prevent me from undertaking ſuch experiments myſelf.

are ſucceeded by great and uninterrupted heats. For the earth being thus drenched with moiſture, and the low lands overflowed with water, the exhalations become conſtant, copious, and often putrid.

JOAN LEO in his hiſtory of Africa relates, that if heavy rains fall in that country during the months of July and Auguſt, the plague uſually breaks out the September following *(d)*. But in European climates it is well remarked by Sir John Pringle, that frequent ſhowers in ſummer cool the air, check the exceſs of vapour, dilute and refreſh the corrupted waters, and precipitate the noxious effluvia which float in the atmoſphere *(e)*. And it appears from a variety of obſervations which I have collected, that October, November, and December are generally

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(d) Hiſt. Africæ, Lib. 1. Cap. 10.

(e) Vid. Sir John Pringle on the Diſeaſes of the Army, p. 5, ed. 4.

nerally very healthy, although the moſt rainy months in the year. I ſhall ſubjoin a table which will ſet this point in the cleareſt light; and at the ſame time ſhew the comparative mortality of the different ſeaſons at Middleton, Bowden, Chowbent, Diſhley, Middlewich, Richmond, and Mancheſter.

A TABLE SHEWING THE COMPARATIVE MORTALITY OF THE DIFFERENT SEASONS OF THE YEAR.

	Middleton from 1663 to 1673. Ten years.	Middleton from 1763 to 1773. Ten years.	Bowden from 1663 to 1673. Ten years.	Bowden from 1763 to 1773. Ten years.	Mancheſter from 1766 to 1774 *. Eight years.
January, February, March,	117.	265.	179.	259.	1538.
April, May, June,	99.	291.	139.	300.	1366.
July, Auguſt, September,	79.	215.	114.	209.	957.
October, November, December.	72.	222.	127.	207.	1339.

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* This account is taken from the regiſter of the collegiate or pariſh church only.

	Chowbent from 1767 to 1773. Six years.	Diſhley from 1763 to 1773. Ten years.	Middlewich from 1768 to 1773. Five years.	Richmond from 1764 to 1774. Ten years.	Rochdale from 1760 to 1773. Thirteen years.
January, February, March,	71.	64.	67.	170.	1533.
April, May, June,	37.	78.	55.	156.	1336.
July, Auguſt, September,	28.	51.	59.	172.	1077.
October, November, December.	33.	43.	69.	144.	1239.

Total.

Total.	Jan.	Feb.	March.	4263.
	April.	May.	June.	3857.
	July.	Aug.	Sep.	2961.
	Oct.	Nov.	Dec.	3495.

There is a conſiderable diverſity in the ſituation of theſe places. Middleton lies ſix miles north eaſt of Mancheſter, not far from the great chain of mountains which divides Lancaſhire and Yorkſhire; and about thirty ſix miles from the ſea.

Bowden is ten miles to the ſouth weſt of Mancheſter, and thirty five miles from the ſea. It is an elevated ſituation, in a level country; and at a great diſtance from any hills.

Chowbent is ten miles weſtward of Mancheſter, and twenty five miles diſtant from the ſea. It is in a low and flat ſituation, and near a very extenſive moraſs.

Dishley is in that part of Cheſhire, which borders on the peak of Derbyſhire. It is a mountainous ſituation, thirteen miles ſouth eaſt of Mancheſter, and fifty miles from the ſea.

Middlewich is twenty eight miles ſouthward of Mancheſter, and about forty miles from the ſea. It is ſurrounded by a well cultivated and level country.

Richmond is a conſiderable market town in the north riding of Yorkſhire, about forty miles diſtant from the German Ocean. It ſtands on an eminence, which terminates a long continued range of mountains. The country below is an extenſive, rich and well cultivated plain.

The obſervations of Dr. Franklin on the ſubject of moiſture will, I doubt not,

be very acceptable to the medical reader, although he may not entirely acquieſce in the opinion of this excellent philoſopher. I ſhall therefore give a farther quotation from the letter before referred to. " The gentry of England are re-
" markably afraid of moiſture, and of
" air. But ſeamen who live in perpetu-
" ally moiſt air, are always healthy if
" they have good proviſions. The inha-
" bitants of Bermudas, St. Helen and
" other iſlands far from continents, ſur-
" rounded with rocks, againſt which the
" waves continually daſhing fill the air
" with ſpray and vapour, and where no
" wind can ariſe that does not paſs over
" much ſea, and of courſe bring much
" moiſture, are remarkably healthy.
" And I have long thought mere moiſt
" air has no ill effect on the conſtitution;
" though air impregnated with vapours
" from putrid marſhes is found pernici-
" ous, not from its moiſture but pu-

" tridity. It ſeems ſtrange that a man
" whoſe body is compoſed in great
" part of moiſt fluids, whoſe blood and
" juices are ſo watery, who can ſwallow
" quantities of water and ſmall beer daily
" without inconvenience, ſhould fancy
" that a little more or leſs moiſture in
" the air ſhould be of ſuch importance.
" But we abound in abſurdity and in-
" conſiſtency."

In the former paper I gave a ſtriking example of the great advantages of diligence and ſobriety in *the length of days* which the people of Monton enjoy. Such an inſtance though a ſingle one, affords the moſt animating leſſon of morality; and I can enforce it by farther proofs.

The Rev. Mr. Harrop has favoured me with an account of the people who attend Divine Service in the Chapel at

Hale, near Altringham, which he has lately taken with a retroſpect of the births and deaths amongſt them during the laſt ſeven years. The ſociety is compoſed of 140 males, 136 females, 92 married perſons, 8 widowers, 12 widows, 105 under fifteen years of age, and 41 above fifty. The deaths during ſeven years have been 28, and the births 68. It appears from this enumeration that only one in 69 of the people, who are moſt of them farmers, dies annually. Hale is a low ſituation, and the ſoil is clayey.

THE congregation belonging to the Chapel at Horwich conſiſts of 305 individuals, viz. 149 males, and 156 females, 94 married perſons, and 9 widowers, 8 widows, 127 under fifteen years of age, and 50 above fifty. The births for the laſt ſeven years have amounted to 101, and the deaths to 32. Hence the yearly proportion of deaths to the inhabitants is as 1 to 66. Horwich is between Bolton and Chorley, the country is mountainous, and the people are compoſed almoſt equally of farmers and manufacturers. I am obliged to the Rev. Mr. Evans for this account.

The Rev. Mr. Smalley of Darwen, three miles from Blackburn in Lancaſhire, has tranſmitted to me the following ſurvey of his congregation. It conſiſts of 1850 individuals; 900 males; 950 females; 640 married perſons; 30 widowers; 48 widows; 737 perſons under the age of fifteen, and 218 above fifty. During the laſt ſeven years the deaths have amounted to 233; and the births to 508. The annual proportion of deaths therefore is 1 in 56; and the births are to the number of inhabitants nearly as 1 to 25.5. Darwen is a country diſtrict, bleak and elevated in its ſituation, ſurrounded by moors, and ill cultivated.

vated. The inhabitants are chiefly employed in the cotton manufactory.

A CLERGYMAN in the peak of Derbyſhire has, at my deſire, undertaken an enumeration of the people of Edale, a fertile valley in that part of the county, inhabited by a ſober and induſtrious race of farmers. But I have not yet received a particular account of the ſurvey; and have only been informed that 1 in 59 of the inhabitants dies annually, on an average of ten years.

THE principles and manners of the Quakers, though often made the ſubjects of illiberal cenſure and ridicule, may probably afford them advantages with reſpect to the duration of life over other bodies of men. The diligence, cleanlineſs, temperance and compoſure of mind, by which the members of this ſociety are in general diſtinguiſhed, may reaſonably be ſuppoſed to contribute to health and longevity: And as there are no perſons among them in abject poverty, and few immoderately rich, this more equal diſtribution of property muſt leſſen the ſources of diſeaſe, and furniſh every individual under it with the neceſſary means of relief. Theſe conſiderations excited my curioſity to know the proportion of deaths amongſt the Quakers in Mancheſter; and I have been gratified by Mr. Routh, in the moſt obliging manner, with the following information. The ſociety conſiſts of 81 males; and 84 females; 54 married perſons; 9 widowers; 7 widows; and 48 perſons under fifteen years of age. The births during the laſt ſeven years have amounted to 34; and the burials to 47. About 1 therefore in 24.6 of the Quakers in Mancheſter dies annually; whereas the proportion of deaths amongſt the inhabitants of the town at large is as 1 to 28. If no allowance be made for the temporary and accidental irregularities which may occur in a ſingle and ſmall body of men, when the average of a few years has only been taken, a concluſion directly contrary to what I have preſuppoſed, will be drawn from this fact. And perhaps it will be urged that the want of vivacity in the people of this ſect, and the ſedentary lives of their females, are cauſes which ſhorten the period of their exiſtence, and counterbalance the advantages from cleanlineſs and ſobriety which they enjoy. But the reader will entertain a different opinion concerning this point, when he is informed that the Quakers here have had few or no acceſſions to their number, by ſupplies from other places, during the laſt ſeven years. This muſt conſiderably increaſe their proportional mortality, for reaſons which have been before aſſigned; and is the true cauſe why the deaths amongſt them ſo much exceed the births. Were it not for new ſettlers in the prime of life, who annually pour into Mancheſter, it is probable that more than 1 in 25 of its inhabitants would die annually. So baleful is the influence of large towns on the duration of life; and ſo juſtly are they ſtyled, by a writer of the moſt diſtinguiſhed abilities (a), the *graves* of mankind.

The Rev. Mr. Barnes, whom I cannot mention without expreſſions of eſteem and friendſhip, made a ſurvey in September, 1773, of the people belonging to the new chapel at Cockey Moor, near Bolton, the particulars of which are as follow:

Houſes	150.
Families	154.
Males	320.
Females	391.
Married perſons	248.
Widowers	10.
Widows	27.

Under

(a) Dr. Price.

Under fifteen	252.
Above fifty	99.
Births in five years	125.
Deaths in ſeven years	114.
Total number of people	711.

THE married perſons in this ſociety are therefore to the ſingle as 1 to 1 .867; the widows are nearly treble the number of widowers; a ſeventh part of the people have attained the age of fifty, and thoſe under fifteen exceed one third of the whole congregation. The average number of births is 25 every year, and of deaths $16\frac{2}{7}$; ſo that the former are to the latter in the proportion of ſomewhat more than 5 to 3; and 1 perſon in about 44 dies annually. It ſhould be remarked, that the number of deaths in this period was conſiderably increaſed by the uncommon fatality of the ſmall-pox in the year 1770. Cockey Moor is ſurrounded by a cold, wet, and barren country; the inhabitants are farmers and manufacturers.

The congregation belonging to the chapel at Chowbent conſiſts of 1160 perſons, viz. 554 males; 606 females; 173 males, and 150 females under ten years of age; 83 males, and 91 females above fifty; 6 males, and 4 females above eighty; 199 married couples; 26 widowers; and 43 widows. The baptiſms during ſix years (wanting ſix weeks) have amounted to 293; and the deaths to 169. About 1 therefore in 41 .2 of this ſociety dies annually. This ſurvey was made in November, 1773, by the Rev. Mr. Mercer. The people of Chowbent are employed chiefly in the manufactories of cotton, linen, and iron.

At Ackworth, near Ferry-bridge in the county of York, the chriſtenings and burials for ten years, viz. from March

25th. 1757, to March 25th. 1767, have been as follow:

CHRISTENINGS.		BURIALS.	
Males	104.	Males	79.
Females	108.	Females	77.
Total	212.	Total	156.

OF this number have died,

	Males.	Females.	Total.
Under 2 years old	18	13	31
Between 2 and 5	9	7	16
5 and 10	4	1	5
10 and 20	2	2	4
20 and 30	7	5	12
30 and 40	3	8	11
40 and 50	2	4	6
50 and 60	11	3	14
60 and 70	13	13	26
70 and 80	7	14	21
80 and 90	3	6	9
90 and 100	0	1	1
Of all ages in ten years	79	77	156

DISEASES.	Males.	Females.	Total.
Child-bed	0	2	2
Chincough	0	2	2
Conſumption	23	15	38
Diabetes	1	0	1
Fever	12	11	23
Infants	7	6	13
Meaſles	0	2	2
Old Age	11	19	30
Small Pox	7	6	13
Dyſentery	1	1	2
Dropſy	0	3	3
Apoplexy	2	1	3

IN this pariſh there are,

184 Houſes, eleven of which are uninhabited.

728 Perſons, of the following ages, viz.

	Males.	Females.	Total.
Under 2 Years old	31	25	56
Between 2 and 5	32	36	68
5 and 10	34	38	72
10 and 20	50	51	101
20 and 30	44	63	107
30 and 40	61	62	123
40 and 50	31	38	69
50 and 60	28	32	60
60 and 70	20	28	48
70 and 80	7	10	17
80 and 90	2	4	6
90 and 100	0	1	1
Of all ages—Total	340	388	

THIS account of Ackworth was lately tranſmitted to my friend Mr. White, by the Rev. Dr. Lee, Rector of the pariſh. It appears that 1 in 46 .6 of the inhabitants dies yearly; and that the proportion of perſons to each tenanted houſe is 4 $\frac{1}{5}$. Amongſt the males under 2 years of age, the number of deaths exceeds by a third thoſe amongſt the females; and 43 women and only 29 men have attained the age of ſixty and upwards. Theſe facts (and I could adduce many ſimilar ones) confirm a curious remark lately advanced by Dr. Price, that the life of males is more frail than that of females.

I SHALL conclude this Paper with a Table deduced from the preceding obſervations.

FEB. 1ſt. 1774.

A TABLE SHEWING THE PROPORTION OF INHABITANTS DYING ANNUALLY IN SEVERAL DIFFERENT PLACES.

Manchester.	Leverpool.	Chowbent.	Eastham.	Cockey.	Royton.
1. in 28.	1. in 27 ·7.	1. in 41.	1. in 35.	1. in 44.	1. in 52.
Darwen.	Edale.	Ackworth.	Horwich.	Hale.	Monton.
1. in 56.	1. in 59.	1. in 47.	1. in 66.	1. in 69.	1. in 68.

OBSERVATIONS

ON THE

STATE OF POPULATION

IN

MANCHESTER,

AND OTHER ADJACENT PLACES,

CONCLUDED.

A VERY accurate ſurvey was compleated laſt year of the towns of Mancheſter and Salford, with their reſpective townſhips. This ſpring an enumeration, equally exact and comprehenſive, has been made of the whole pariſh of Mancheſter; which comprehends thirty one townſhips (excluſive of the two above-mentioned) in the compaſs of leſs than ſixty ſquare miles. The reader is here preſented with the particulars of this enumeration.

Tenanted houſes	2371.
Families	2525.
Inhabitants	13,786.
Males	6942.
Females	6844.
Married	4319.
Widowers	232.
Widows	315.
Under fifteen	5545.
Above fifty	1762.
Above ſixty	470.
Above ſeventy	261.
Above eighty	87.
Male lodgers	68.
Female lodgers	51.
Empty houſes	41.

THE number of perſons to a houſe, in the pariſh of Mancheſter, is therefore nearly $5\frac{2}{3}$; of individuals to a family about $5\frac{1}{2}$; and $\frac{7}{8}$ of the inhabitants have attained the age of fifty. It is unneceſſary to point out the difference in the proportions between the *Town* and adjacent *Country*, as it will appear ſufficiently obvious by comparing this account with that of Mancheſter. The whole number of inhabitants in the town, townſhip, and pariſh of Mancheſter, amounts to 42937.

At the cloſe of 1772, an account was collected from every country chapel, both Epiſcopal and Diſſenting, in the pariſh, of the baptiſms and burials of that year. The former were found to amount to 401; the latter to 246; and there is a preſumption that this is nearly the annual proportion of deaths in the pariſh of Mancheſter, excluſive of the town and townſhip. For the number of burials in the whole pariſh was, in the ſame year, exactly 1200; and it has been ſhewn that the deaths in the town of Mancheſter are, one year with another, 958. This ſum being ſubtracted from 1200, leaves a remainder (242) for the country, very nearly equal to 246. And if 13786, the number of people in the pariſh, be divided by 246, it will appear that only 1 in 56 of the inhabitants dies annually; whilſt the yearly mortality in Mancheſter is as 1 to 28. Such a ſtriking diſparity in the healthineſs of a large town, and of the country which ſurrounds it, granting it to be leſs than has been ſuppoſed, will ſcarcely be credited by thoſe, who have paid no attention to inquiries of this nature. And it muſt afford matter of aſtoniſhment even to the phyſician and philoſopher, when he reflects, that the inhabitants of both live in the ſame climate, carry on the ſame manufactures, and are chiefly ſupplied with proviſions from the ſame market. But his ſurpriſe will give place to concern and regret, when he obſerves the havoc produced in every large town by luxury, irregularity, and intemperance *(a)*; the numbers that fall annual victims to the contagious diſtempers, which never ceaſe to prevail; and the pernicious influence of confinement, uncleanlineſs, and foul air on the duration of life *(b)*.

YE who amid this feveriſh world would wear
A body free of pain, of cares a mind;
Fly the rank city, ſhun its turbid air;
Breathe not the chaos of eternal ſmoke
And volatile corruption, from the dead,
The dying, ſickening, and the living world
Exhaled, to ſully heaven's tranſparent dome
With dim mortality. It is not air
That from a thouſand lungs reeks back to thine,

Sated

(a) THERE are at this time, in Mancheſter, no leſs than 193 licenced houſes for retailing ſpirituous and other liquors.

(b) THE Rev. Dr. Tucker, Dean of Glouceſter, informs me, "That were it not for the daily arrival of "recruits from the country, his pariſh (St. Stephens, "in Briſtol) and indeed Briſtol in general, would be "left in a century without an inhabitant; unleſs the "people ſhould betake themſelves to better courſes."

Sated with exhalations rank and fell,
The ſpoil of dunghills and the putrid thaw
Of nature; when from ſhape and texture ſhe
Relapſes into fighting elements:
It is not air, but floats a nauſeous maſs
Of all obſcene, corrupt, offenſive things.

Armſtrong on Health, Book 1.

GREAT towns are in a peculiar degree fatal to children. Half of all that are born in London die under two, and in Mancheſter under five years of age; whereas at Royton, a country townſhip not far diſtant from Mancheſter, the number of children dying under the age of three years, is to the number of children born only as 1 to 7.

IT is a common, but injurious practice in manufacturing countries to confine children, before they have attained a ſufficient degree of ſtrength, to ſedentary employments, in places where they breathe a putrid air, and are debarred the free uſe of their limbs. The effect of this confinement,

finement, ſays an able writer, is either to cut them off early in life, or to render their conſtitutions feeble and ſickly. But the love of money ſtifles the feelings of humanity, and even makes men blind to the very intereſt they ſo anxiouſly purſue. The ſame principle of ſound policy which induces them to ſpare their horſes and cattle, till they arrive at a due ſize and vigour, ſhould determine them to grant a proportionable reſpite to their children (*c*). And this obſervation may, perhaps, be extended to the untimely culture of the mind. For too early an application to ſtudy impairs the faculties, injures the conſtitution, and hurts the temper by frequent contradiction. Almoſt as ſoon as a boy has acquired the powers of ſpeech, he is ſhut up many hours every day in a noiſome ſchool, ſecluded from the benefit of exerciſe and the

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(*c*) See Dr. Gregory's Comparative View of the State and Faculties of Man, &c.

the refreſhment of the open air, and tied down to the ſevere drudgery of learning what ſerves only, at ſuch a period of life, to overcharge his memory, and to deſtroy his native chearfulneſs of diſpoſition. Thus the age of gaiety (to uſe the words of the elegant writer before referred to) is ſpent in the midſt of tears, puniſhments, and ſlavery; and this to anſwer no other end but to make a child a man, ſome years before nature intended he ſhould be one.

The Rev. Mr. Harriſon of Chapel in le Frith has made a ſurvey, at my requeſt, of the inhabitants of Chinley, Brownſide, and Bugſworth; three hamlets contiguous to each other, in the pariſh of Gloſſop, and peak of Derbyſhire. They are four ſtatute miles in length, and three in breadth; and contain 301 males; 310 females; 200 married perſons; 15 widowers; 18 widows; 234 perſons under fifteen years of age; 121

above fifty; and 9 who have attained the age of eighty. This enumeration was finiſhed in September, 1773.

I HAVE been furniſhed by the Rev. Mr. Aſsheton, Rector of Middleton near Mancheſter, with an account of the births, deaths, and marriages in his pariſh, during ten correſponding years of the laſt, and of the preſent century. From 1663 to 1672 incluſive, the deaths were, males 180, females 187; the births, males 200, females 188; the marriages 121.

THE births therefore, during ten years, only exceeded the deaths in number 21; and the average number of births to each marriage, was as $3\frac{1}{5}$ to 1.

FROM 1763 to 1772 incluſive, the deaths were, 499 males, 494 females; the chriſtenings, 802 males, 768 females; the marriages 330. The baptiſms therefore,

fore, during this period, exceeded the deaths 577, that is, near 58 annually. And if no allowance be made for illegitimate births (which, I believe, in this pariſh are not numerous, and can no where be ſuppoſed equal to one fourth of all that are born) each marriage has produced $4\frac{7}{10}$ children.

It is curious to obſerve the change both in the proportion of births to the deaths, and alſo to the marriages, which has taken place at Middleton (and I have received ſimilar accounts of other places) during the courſe of the laſt century. The former may be explained by the greater encouragement to matrimony, from the increaſe of trade: the latter is of more difficult ſolution; though it is probable that the warmer cloathing, and better fare, which the poor now enjoy, may have contributed to it. Luxury, when carried to ſuch a degree as to enervate the conſtitution, is unfavourable to population; but plenty of nutritive diet may well be regarded as a ſource of fruitfulneſs. The lower claſs of people in this country, formerly lived upon the coarſeſt food. Wheat, an hundred years ago, was almoſt unknown to them; and ſo lately has it been cultivated in Lancaſhire, that it has ſcarcely yet acquired the name of corn, which in general is applied only to barley, oats, and rye. Potatoes alſo are much improved by the preſent judicious method of growing and propagating them; and they now conſtitute a moſt wholeſome and nouriſhing part of our diet.

A PHYSICIAN, of the firſt rank in his profeſſion, has ſuggeſted to me that tea may be conſidered as a powerful aphrodiſiac; and he imputes the amazing population of China, amongſt other cauſes, to the general uſe of it *(d)*. But the Dutch,

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(d) IN China, the women are ſo prolific, and the human

Dutch, who drink large quantities of the infuſion of this vegetable, are ſo far from being remarkable for the number of their children, that I have been well informed, two births to a marriage is the common proportion in Holland.

It muſt be acknowledged, however, that warm infuſions of tea, by relaxing and augmenting the ſenſibility of the fibres, which in cold climates, and in hard labouring people, are uſually too rigid and torpid, may promote the increaſe of the human ſpecies. But the obſervation is true only under certain limitations; for the ſame cauſe, by debilitating the conſtitution beyond the due medium, may operate in a contrary manner. Perhaps the general uſe of pepper, and of other ſpices, may increaſe the fertility of mankind.

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human ſpecies multiplies ſo faſt, that the lands, though ever ſo much cultivated, are ſcarcely ſufficient to ſupport the inhabitants. *Monteſquieu.*

But I ſhall ſuſpend my conjectures for the preſent. A variety of cauſes may counteract the operation of thoſe which I have enumerated; and a conſiderable number of facts muſt be adduced to aſcertain, whether the proportion of births to marriages be generally increaſed in countries advanced from poverty to wealth, by the introduction of trade, or the improvement of agriculture. The inſtance of Middleton, and of one or two places more which firſt occurred, and ſuggeſted the preceding obſervations, is oppoſed by others which have lately fallen under my notice. And I cannot cloſe this ſubject better, than by giving a view of all the facts, which I have collected on both ſides of the queſtion.

A TABLE SHEWING THE PROPORTION OF BIRTHS TO MARRIAGES IN DIFFERENT PLACES, AND AT DIFFERENT PERIODS OF TIME.

Year.	Marriages.	Chriſtenings.	Births to a Marriage.
MIDDLETON.			
From 1663 to 1672,	121	388	$= 3\frac{1}{5} +$.
1763 to 1772,	330	1570	$= 4.7$.
WARRINGTON.			
From 1702 to 1722,	131	385	$= 2.9$.
1752 to 1772,	1549	5034	$= 3\frac{1}{4}$.
PENTRAETH PARISH, ANGLESEY*.			
From 1740 to 1747,	32	100	$= 3\frac{1}{8}$.
1764 to 1771,	33	149	$= 4\frac{1}{2}$.
LLANDYFNAN PARISH, ANGLESEY*.			
From 1750 to 1757,	28	111	$= 4$.

From

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* See Philoſophical Tranſactions, Vol. 63.

Year.	Marriages.	Chriſtenings.	Births to a Marriage.
From 1764 to 1771,	32	154	= $4\frac{3}{4}$.
1547 to 1554,	8	36	= $4\frac{1}{2}$.
1620 to 1627,	20	44	= $2\frac{1}{5}$.

LEVERPOOL.

From 1700 to 1710,	500	2127	= $4\frac{1}{4}$.
1762 to 1771,	4812	10010	= $2\frac{1}{12}$.

BOWDEN.

From 1653 to 1662,	136	573	= $4\frac{1}{5}+$.
1763 to 1772,	369	1300	= $3\frac{1}{2}$.

MANCHESTER.

From 1763 to 1773,	4396	11052	= $2\frac{1}{17}$.

From the whole about 2 $\frac{2}{5}$ births to 1 Marriag
Exclusive of the great Towns Manchester
Leverpool & Warrington about 3 $\frac{19}{20}$ or nea
4 births to 1 Marriage. The great town
taken separately about 2½ to 1 Marriag

I HAVE lately received from the Rev. Mr. Archdeacon Blackburne, Rector of Richmond in Yorkſhire, the following account of his pariſh. From the year 1764 to 1773 incluſive, 452 males, and 376 females have been baptiſed; and 299 males, and 341 females have been buried. The marriages during this period have amounted to 200. In Richmond there are about ſix hundred houſes; but the Eaſter Book enumerates only 450 families; and Mr. Blackburne computes the number of inhabitants to be 2300. "We have no diſtempers, he ſays, that "can be called endemial; and when "fevers prevail in the neighbourhood, "few are affected by them in this town. "If any perſon brings an ague to Rich-"mond, he is generally freed from it in "a few days; though the village of "Gilling, about a mile and a half diſ-"ant, which ſtands low, and has a large "pool of ſtagnant water adjoining to it,

“ is viſited with this complaint every
“ ſpring and autumn.

“ The air of Richmond ſeems to be
“ peculiarly unfavourable to conſumptive
“ diſorders. Many ſtrangers come hither,
“ from different parts, in the firſt
“ ſtage of the *phthiſis pulmonalis*; but
“ after thirty five years experience I may
“ truly ſay that not one has recovered;
“ although the utmoſt care and attention
“ has been paid to their reſpective caſes.
“ The natives and conſtant reſidents
“ however are not ſubject to diſtempers
“ of the lungs, except when brought
“ on by intemperance. But rheumatic
“ complaints are very general, eſpecially
“ amongſt the ſenior part of the inhabitants.
“ In ſmall corporation towns
“ like Richmond, numbers are taken off
“ by exceſſive drinking; but the people
“ here who live temperately ſeldom
“ die earlier than in their eightieth
“ year.”

HAPPENING to paſs through Sutton-Coldfield in Warwickſhire, laſt ſummer, I was very much ſtruck with the beauty and apparent healthfulneſs of its ſituation; and was deſirous of knowing the duration of life which the inhabitants of it enjoy. The Rector of the pariſh has, with great politeneſs and good nature, gratified my curioſity as far as he is able, by furniſhing me with an extract from the church regiſter, and by referring me to the xxxii. vol. of the Gentleman's Magazine, for the following authentic account of the place, drawn up I ſuppoſe by himſelf.

"SUTTON-COLDFIELD is almoſt full
" ſouth of Litchfield, at the diſtance of
" about eight meaſured miles, by which
" it undoubtedly got its name of Sutton,
" a contraction of South town: A remark-
" ably bleak and barren common, which
" lies directly weſt of it, juſt out of the
" bounds of the pariſh, might probably

“ give it the additional denomination of
“ Coldfield; the air being, upon that
“ heath, as keen and cold as in the High-
“ lands of Scotland. The pariſh is
“ nearly oval in its figure; the longeſt
“ diameter ſeven miles, and the breadth
“ four. The face of it is agreeably di-
“ verſified with gently riſing hills, and
“ vallies of tolerably fruitful meadows.
“ It is bounded on the north by Kenſton,
“ on the weſt by Barr, on the ſouth by
“ Curdworth, and Aſton near Birming-
“ ham, and on the eaſt by Middleton:
“ It contains four hamlets, viz. Mancy,
“ Hill, little Sutton, and Warmley. In
“ the year 1630, there were 298 houſes
“ in the pariſh; in 1698 there were 310;
“ in 1721 the number was increaſed to
“ 360, which is nearly about the num-
“ ber at preſent. I compute the inha-
“ bitants at 1800. The regiſter begins
“ in the year 1603. The number of
“ chriſtenings for the firſt 20 years of the
“ regiſter was 645; the burials during
“ the

“ the ſame period were 501. The num-
“ ber of chriſtenings for the laſt 20 years
“ (ending at Chriſtmas 1761) was 747;
“ the burials 694 *(a)*.”

It is curious to obſerve the almoſt exact proportion which the chriſtenings bear to the burials, in two very diſtant periods of time. But the like proportion ſeems to hold no longer. For from 1762 to 1772 the births have been 655, the deaths 445. The vicinity of Birmingham, and the amazing extenſion of its manufactures, will account for this change; which ſeems to have ariſen from the recruits annually drawn from Sutton-Coldfield, as well as from every other adjacent place. If the number of inhabitants of this town be rightly computed, the yearly mortality amongſt them is only as 1 to 51; and every

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(a) Gentleman's Magazine for September 1762, p. 401.

every houſe, at a medium, contains five perſons.

It appears by the obſervations lately communicated to me by the Rev. Doctor Tucker, that the number of females baptiſed at the pariſh church of St. Stephens in Briſtol, from 1754 to 1774, have exceeded the number of males baptiſed during the ſame period of time; and that the like remark has been made in ſome other pariſhes of the ſame city. From theſe facts the learned Dean concludes that Dr. Derham's calculation, which ſuppoſes the proportion of male to female births to be as 13 to 12, may probably be erroneous; and he expreſſes his earneſt wiſh that further inquiry may be made into a ſubject of ſo much importance. The following table will ſhew the reſult of the few obſervations which I have collected.

A COMPARATIVE VIEW OF THE NUMBER OF MALES AND FEMALES, BAPTISED IN DIFFERENT PLACES.

Places.	Males.		Females.
Diſhley, 11 years -	149	-	145
St. Stephen's pariſh, Briſtol, 20 years	591	-	607
Taxal, 16 years -	204	-	230
Richmond, 10 years	452	-	376
Middleton, 10 years	200	-	188
Bowden, 10 years -	663	-	639
Middlewich, 5 years	229	-	242
Chapel in le Frith, 10 years	451	-	332
Warrington, 1 year	175	-	181
Collegiate Church in Mancheſter, 7 yrs.	3215	-	3024
Royton, 10 years -	134	-	120
Cheſter, 2 years -	408	-	415
Total.	6871	-	6499

From this table it appears that the proportion of males to females baptiſed is nearly as 12 to 11; but the ſucceeding ones ſhew that the number of females alive conſiderably exceed the number of males, in a variety of places; and that the widows are almoſt double the number of widowers.

A COMPARATIVE VIEW OF THE NUMBER OF MALES AND FEMALES IN DIFFERENT PLACES.

Places.	Males.	Females.
Mancheſter	10548	11933
Salford	2248	2517
Townſhips of ditto	947	958
Pariſh of Mancheſter	6942	6844
Bolton	2159	2392
Little Bolton	361	410
Monton	196	190
Hale	140	136

Horwich

Places.	Males.	Females.
Horwich	149	156
Darwen	900	950
Cockey	320	391
Chowbent	554	606
Ackworth	340	388
Eaſtham	451	461
Chinley	181	168
Brownſide	40	47
Bugſworth	80	95
Aſhton under line	1406	1453
Pariſh of ditto	2584	2513
Tattenhall Pariſh	382	399
Waverton Pariſh.	310	332
Total.	31238	33339

A COMPARATIVE VIEW OF THE NUMBER OF WIDOWERS AND WIDOWS, IN DIFFERENT PLACES.

Places.	Widowers.	Widows.
Mancheſter	432	1064

Salford

Places.	Males.		Females.
Salford - -	89	-	149
Townſhip of ditto -	21	-	42
Pariſh of Mancheſter	232	-	315
Monton - -	14	-	13
Hale - -	8	-	12
Horwich - -	9	-	8
Darwen - -	30	-	48
Cockey - -	10	-	27
Chowbent - -	26	-	43
Chinley, Brownſide, and Bugſworth	15	-	18
Aſhton under line -	50	-	81
Pariſh of ditto - -	67	-	95
Total.	1003		1915

LET no arguments in favour of polygamy be drawn from theſe tables! The practice is brutal; deſtructive to friendſhip and moral ſentiment; inconſiſtent with one great end of marriage, the education of children; and ſubverſive of the natural rights of more than half of the ſpecies.

> —— HIGHER of the genial bed by far,
> And with myſterious reverence I deem.
>
> MILTON.

NOR is this tyranny of man over the weaker, but more amiable ſex, favourable to population. For notwithſtanding the number of females in the world may conſiderably exceed the number of males, yet there are more men capable of propagating their ſpecies, than women capable of bearing children. This painful office gradually becomes more dangerous, and leſs frequent as the rigidneſs of the fibres increaſe; and ceaſes entirely at the age of fifty. The fatality of it is thus wiſely obviated, and the comforts of declining life are not interrupted by the arduous toil of nurſing. An inſtitution therefore which confines in ſervile bondage to one uſurper, ber, many females in the prime of youth, muſt leave numbers deſtitute of the means which nature has pointed out for perpetuating and increaſing the race of mankind. And it is a fact well known that Armenia, in which a plurality of wives is not allowed, abounds more with inhabitants than any other province of the Turkiſh Empire.

JUNE 5th. 1774.

P. S. SINCE the preceding Paper was written, the Rev. Mr. Craddock has favoured me with a ſurvey of the town and pariſh of Aſhton under Line, diſtant about eight miles from Mancheſter. The inhabitants conſiſt of manufacturers and farmers.

AN ENUMERATION OF THE INHABITANTS OF THE TOWN AND PARISH OF ASHTON UNDER LINE, MADE IN 1775.

	Town.		Pariſh.
Inhabitants - -	2859	-	5097
Houſes - - -	553	-	941
Families - - -	599	-	971
Males - - -	1406	-	2584
Females - -	1453	-	2513
Married - -	982	-	1679
Widowers - -	50	-	67
Widows - - -	81	-	95
Under five years of age	509	-	896
From five to ten -	396	-	764
ten to twenty	541	-	1011
twenty to fifty	1044	-	1882
fifty to ſeventy	307	-	471
ſeventy to ninety	62	-	73

THE Reverend Dr. Peploe, Chancellor of the dioceſe of Cheſter, has honoured me with the following account of the pariſhes of Waverton and Tattenhall, both in the neighbourhood of Cheſter. The inhabitants are farmers and labourers.

AN ENUMERATION OF THE INHABITANTS OF TATTENHALL, MADE IN AUGUST 1774, BY THE REVEREND BRICE STORR, CURATE.

Inhabited Houſes - -	148.
Uninhabited ditto -	2.
Heads of families -	176.
Aged above fourteen years	462.
Men and boys - -	382.
Women and girls -	399.

CHRISTEN-

	Christenings.	Burials.
1764	28	8
1765	21	9
1766	19	12
1767	29	11
1768	28	16
1769	24	15
1770	37	15
1771	30	9
1772	26	15
1773	38	20
	280	130

AN ENUMERATION OF THE INHABITANTS OF WAVERTON, MADE IN AUGUST 1774, BY THE REVEREND MR. BISSELL, MINISTER OF THE PARISH.

Inhabited Houſes	109.
Uninhabited ditto	2.
Heads of families	116.

Aged

Aged above fourteen years	406.
Men and boys - -	310.
Women and girls -	332.

		Christenings.		Burials.
1764	-	19	-	10
1765	-	26	-	2
1766	-	17	-	7
1767	-	18	-	10
1768	-	22	-	10
1769	-	17	-	7
1770	-	20	-	8
1771	-	23	-	9
1772	-	18	-	12
1773	-	13	-	9
		193		84

In the valuable work which I have ſo often quoted, Dr. Price has given many convincing and melancholy proofs of the declining ſtate of population in this kingdom. The growth of large towns, the prevalence of vice and luxury, the diſcouragements to marriage, the deſtruction of cottages, and various other cauſes, have the moſt unfavourable influence on the increaſe of mankind. But it is to be hoped that theſe evils do not univerſally prevail, and that even ſome good may ariſe from them to check their baneful effects. Certain it is, that in this part of England the inhabitants multiply with great rapidity: And though the increaſe may be chiefly owing to recruits drawn from other counties, yet the flouriſhing ſtate of our manufactures cannot fail to promote population, by affording plentiful means of ſubſiſtence to the poor. The Biſhop of Cheſter informs me, that in various pariſh regiſters which he has conſulted, the births have progreſſively become more numerous from generation to generation. At Broxley in Kent, where his Lordſhip was Vicar, he divided the times, from the commencement of the reign of Queen Elizabeth, into periods of twenty one years; and found that the number of births in the firſt period was 310, and in the laſt 525. The increaſe was gradual through the whole time.

TABLES

OF THE

COMPARATIVE MORTALITY

OF THE

SMALL-POX

AND

MEASLES,

&c.

TABLES SHEWING THE NUMBER OF DEATHS OCCASIONED BY THE SMALL-POX IN THE SEVERAL PERIODS OF LIFE, AND DIFFERENT SEASONS OF THE YEAR, TOGETHER WITH ITS COMPARATIVE FATALITY TO MALES AND FEMALES; EXTRACTED FROM THE REGISTER OF THE COLLEGIATE OR PARISH CHURCH IN MANCHESTER, AND FROM OTHER BILLS OF MORTALITY.

ACCURATE and comprehenſive Bills of Mortality furniſh a variety of the moſt curious and important obſervations; and it is to be lamented that they are not univerſally adopted. The general uſes to which they may be applied, have been fully pointed out; and a plan for the eſtabliſhment of them has been propoſed to the conſideration and correction of the public *(a)*. It is one part of this plan, that the regiſter of burials ſhall contain not only a liſt of the diſeaſes of which all die, but alſo expreſs particularly the numbers dying of each diſeaſe *in the ſeveral diviſions of life, and different ſeaſons of the year.* The following Tables will illuſtrate the advantages, which may be derived from this improvement.

(a) Percival's Eſſays Medical and Experimental, Vol. 2. p. 244.

AN ACCOUNT OF DEATHS BY THE SMALL-POX; DURING SIX YEARS, VIZ. FROM 1768 TO 1774; COLLECTED FROM THE REGISTER OF THE COLLEGIATE CHURCH AT MANCHESTER.

TABLE I.

Ages.	Males.	Females.	Annual Deaths by the Small-Pox.		Deaths by all Diſeaſes.
From Birth to 3 Months.	2.	2.	A. D.		
From 3Months to 6 Months	9.	8.	1769.	74.	549.
------ to 1 Year.	51.	68.	1770.	41.	689.
2.	103.	113.	1771.	182.	678.
3.	55.	55.	1772.	66.	608.
4.	33.	26.	1773.	139.	648.
5.	18.	16.	1774.	87.	635.
10.	17.	12.			
20.	1.	0.			
30.	0.	0.			
Total	289.	300.		589*.	3807.

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* THIS account of the Annual Deaths by the Small-Pox from 1768 to 1774, differs from the printed Bills of Mortality; which make the number amount to 586, and not to 589. But it has been extracted from the Church Regiſter with a degree of care and attention not uſually beſtowed upon the printed Bills; and the accuracy of it may, I believe, be relied upon.

I. This Table is formed from a very accurate Regiſter, and affords a ſtriking view of the diſparity in the ravages of the Small-Pox at different periods of life. The proportion of deaths under the age of three months is extremely ſmall; and I think we may conclude that this diſtemper rarely occurs in the early part of infancy. For children in that tender ſeaſon are neither in the way of infection, nor does experience ſhew that they are much diſpoſed to receive it. Dr. Monro informs us, that of twelve infants, inoculated within a fortnight after their birth, not one had the variolous eruption *(b)*. In the ſecond ſtage of infancy the fatality of the Small-Pox is ſomewhat increaſed; but the advancement proceeds afterwards with amazing rapidity. For during the eighteen months which

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(b) Monro on Inoculation, p. 25. Percival's Eſſays Medical and Experimental, Vol. I. p. 372, ſecond edition.

which next ſucceed, the number of deaths amounts to 335; which is more than one half of all that occur through the remainder of life. At this period therefore we may preſume that the body is peculiarly liable to the diſeaſe; and the violence and malignity of it are aggravated by the breeding of teeth, and by the general irritability of the nervous ſyſtem. But the firſt dentition is uſually completed before the end of the third year; at which time the Small-Pox appears by the Table to become conſiderably leſs mortal. And its declenſion is not leſs rapid than its progreſs, as the conſtitution improves in vigour, and as thoſe decreaſe in number who are liable to its attack.

In the year 1773, the Small-Pox raged with great violence in the town of Warrington; and I have procured from my very ingenious friend Mr. John Aikin, an exact account of the number and ages of thoſe who died of it. This account coincides with the foregoing Table, and confirms many of the concluſions which are deducible from it.

DEATHS BY THE SMALL-POX AT WARRINGTON IN 1773.

TABLE II.

Ages.		Numbers.
Under 1 Month	-	0.
From 1 to 3 Months	-	4.
3 -- 6 --------	-	6.
6 -- 12 -------	-	39.
From 1 to 2 Years	-	84.
2 -- 3 ------	-	33.
3 -- 4 ------	-	18.
4 -- 5 ------	-	15.
5 -- 6 ------	-	4.
6 -- 7 ------	-	2.
7 -- 8 ------	-	2.
8 -- 9 ------	-	4.
None above.	Total	211.

II. The Small-Pox, by Table I. appears to have been more fatal to female than to male children, and the difference is conſiderable under the age of two years. At Warrington, two thirds of all who died of this diſeaſe in 1773 were females. Theſe facts are ſomewhat extraordinary; as it has been fully evinced by a variety of obſervations, that the life of males is much more frail than that of females *(c)*, and particularly in the period of infancy *(d)*. They alſo contradict the following remark of Baron Van Swieten: "*Cum autem muliebre Corpus mollius et* "*laxius ſit Corpore virili, hinc cæteris* "*paribus, & in his mitior eſſe ſolet hic* "*morbus.*"

Comment. Vol. 5. p. 16.

III. The

(c) Vide a Treatiſe on Reverſionary Payments, by my learned friend Dr. Price, paſſim; alſo the preceding Obſervations on the State of Population in Mancheſter, and other adjacent Places.

(d) Ibid.

III. The comparative mortality of the Small-Pox at Mancheſter, Warrington, and Chowbent, in the different ſeaſons of the year, may be eſtimated by the following Table.

TABLE III.

Months.	Manchester, From 1768 to 1774.	Warrington, 1773.	Chowbent, From 1767 to 1773.	Total.
January, February, March.	160.	21.	17.	198.
April, May, June.	137.	135.	7.	279.
July, Auguſt, September.	147.	51.	2.	200.
October, November, December.	145.	4.	1.	150.

Sydenham has obſerved that the Small-Pox, when it is mild and regular, uſually commences about the vernal equinox in thoſe years in which it is epidemic; but that it begins earlier when it is of an irregular and more dangerous kind. No one can doubt that variations in the moiſture, dryneſs, temperature, and other qualities of the air, muſt influence a diſeaſe which is always of an inflammatory, and often in its laſt ſtages of a putrid nature. But the progreſs of it cannot be regulated by the ſeaſons, becauſe it is derived from contagion; the communication of which frequently depends upon accident, is confined to no period of time, and is varied by its degrees of malignity. During the late viſitation of the Small-Pox at Warrington, the ſtate of the atmoſphere went through all poſſible changes, but with no perceptible difference in the circumſtances of the diſeaſe *(e)*.

IV. DURING the period of time included in the firſt Table, the Small-Pox was twice epidemical in Mancheſter; and

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(e) See Philoſophical Tranſactions, Vol. 64. p. 439.

and the deaths by it amount nearly to one ſixth and a half of thoſe occaſioned by all other diſeaſes. But it may be proper to remark, that the poor of this town are chiefly buried at the Collegiate Church; and this diſtemper proves much more fatal to them than to perſons of better rank, from their want of cleanlineſs, and their prejudice in favour of a hot regimen. In London, from 1762 to 1772, the average proportion of deaths by the Small-Pox is 109 in 1000, or about a ninth of the whole. And at Ackworth, a country pariſh near Ferrybridge in Yorkſhire, the proportion during twenty years, viz. from 1747 to 1767, is as 1 to 19; two hundred and ſixty-three perſons having been buried, fourteen of whom died of the Small-Pox. Were ſuch accounts to be collected from different places, and at different periods of time, it is probable that farther variations in the fatality of this diſeaſe would be diſcovered (*f*). But from its leaſt deſtructive ravages we may derive arguments, of unanſwerable force, in favour of inoculation. And the two firſt tables may perhaps furniſh ſome uſeful information concerning the particular ſeaſon of life in which this practice will be moſt expedient, and attended with the greateſt proſpect of ſucceſs.

(*f*) Baron Van Swieten has given the following remarkable account of the proportion of deaths by the Small-Pox, in ſeveral ſchools and hoſpitals at Vienna. "*Ratione ſubducta, patet, quod numerus omnium, qui in his locis variolis decubuerunt, ſit* 355, *et quod ex hoc numero ſeptem mortui fuerint. Adeoq; proportio mortuorum ad numerum ſanatorum eſt ut* 1. *ad* 50. *circiter. Si autem de hoc mortuorum numero detraherentur tres aegri, quorum mors ſolis variolis adſcribi nequit, tunc certe proportio mortuorum ad ſanatos foret ut* 1. *ad* 89. *circiter.*"

Van Swieten. Comment. Vol. 5. p. 145.

Mr. Bew, an ingenious apothecary in Mancheſter, informs me that he attended ſeventy patients the laſt year (1774) under the natural Small-Pox, of which number only two died. They were chiefly children above the age of two years; and the cool regimen was ſtrictly purſued in the treatment of them.

V. If we regard only the ſtate of the body, the fitteſt period for the ingraftment of the Small-Pox ſeems to be between the age of two and four in healthy children, and of three and ſix in thoſe who are tender and delicate. The powers of nature are then ſufficiently vigorous; perſpiration is free and copious; the irritability of the body is diminiſhed; the viſcera are ſound and unobſtructed; the mind, though active and lively, is not diſturbed by violent emotions; the teguments are properly extenuated; and the fibres are neither too tenſe nor too lax for the variolous eruption. To theſe important advantages may be added, that at this age the child is both a proper ſubject for preparatory medicines, and for ſuch as may be deemed neceſſary during the courſe of the diſtemper *(g)*. But other conſiderations, beſides the ſtate of the conſtitution, demand our attention. The

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(g) Percival's Eſſays Medical and Experimental, Vol. I. p. 373, ſecond edition.

The riſque of receiving the natural Small-Pox by infection appears to be very great during the ſecond year of life; and the fatality of the diſeaſe at this period is highly alarming. To avert ſuch impending danger, the inoculation of healthy and vigorous children, at the *age of two or three months*, ſeems to be adviſeable, eſpecially in large towns. An earlier period might complicate the Small-Pox with the jaundice, thruſh, gripes, diarrhœa, and other diſorders incident to the firſt ſtage of infancy; and a later ſeaſon may ſuperadd the fever, convulſions, and other ſymptoms of dentition. But I have enlarged upon this ſubject in another work, to which I refer the reader *(h)*.

(h) See Obſervations on the Diſadvantages of inoculating Children in early Infancy; Eſſays Medical and Experimental, Vol. 1. ſecond edition.

TABLES OF THE COMPARATIVE MORTALITY OF THE MEASLES FROM 1768 TO 1774, COLLECTED FROM THE REGISTER OF THE COLLEGIATE CHURCH IN MANCHESTER.

TABLE I.

Ages.	Males.	Females.	Seaſons.	Total of Deaths by all Diſeaſes, during 6 years.
From Birth to 3 Months.	1.	1.	Jan. Feb. March. } 17.	
From 3 Months to 6 Months	3.	0.		
1 Year.	6.	4.	April, May, June. } 51.	
2.	17.	14.		
3.	17.	8.		
4.	4.	3.	July, Aug. Sep. } 16.	
5.	2.	7.		
10.	0.	2.	Oct. Nov. Dec. } 7.	
20.	0.	1.		
30.	0.	1.		
Total	50.	41.	91*.	3807.

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* This, like the firſt Table of the Small-Pox, differs in the total of

THIS Table requires no comments. The proportional mortality of the Meaſles in the ſeveral periods of life, and various ſeaſons of the year, is obvious at the firſt view. It is equally evident alſo that this diſeaſe differs from the Small-Pox, in being much more fatal to males than to females.

DURING the ſpring and ſummer months of the year 1774, the Meaſles were epidemical in Mancheſter, and proved fatal to a conſiderable number of children. They

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of deaths by the Meaſles, from the printed Bills of Mortality. I have therefore deſired Mr. Holme, one of the clerks of the Collegiate Church, a very intelligent man and a good arithmetician, to reviſe the Church Regiſter; and after the moſt careful inſpection, he aſſures me that the numbers in both Tables are perfectly accurate. He ſays, "The printed Bills of Mortality are exact as to the "number of deaths, and the diviſion of males and females; but "when the diſorders are counted over, and the general amount "is taken, there is often a miſtake in the ſum total. And as "it is a great trouble and difficulty to diſcover wherein the error lies, and as few perſons pay any regard to this part of the "bills, it is common to add the number deficient to ſome of the "diſorders, ſo as to make the whole agree."

They were of the regular kind, ſo well deſcribed by Sydenham; but it was not unuſual for violent peripneumonic ſymptoms to occur, five, ſix, or even eight days after the diſappearance of the eruption. Under theſe circumſtances venæſection, bliſters, and the Seneka root were found to be very efficacious remedies. I preſcribed the Peruvian bark with great ſucceſs to many of my patients under the Meaſles, combining it with demulcents, and the ſaline mixture *(a)*; and premiſing venæſection when the ſigns of inflammation were urgent. The practice of giving the bark in this diſeaſe was firſt introduced by Dr. Cameron, a very eminent phyſician at Worceſter. He obſerves that it prevents the receſſion of the morbid acrimony,

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(a) ℞. *Lixivij Tartari drachmas tres, Succi Limonum q. s. ad ſaturationem, Aquæ Cinnamomi tenuis uncias duas, Elixir Paregorici, Vini Antimonialis ana ſeſquidrachmam, Extracti Corticis Peruviani, Extracti Glycyrrhizæ ana ſcrupulos quatuor.* M.

mony, and continues the effloreſcence on the ſkin, ſometimes ſo long as the twelfth day *(b)*. By this ſalutary operation, the cough and other inflammatory ſymptoms are in a great meaſure obviated; and the patient is freed from all danger of a peripneumony, the fatality of which Sydenham deſcribes in ſuch ſtrong terms. It is many years ſince I firſt adopted the method of cure recommended by Dr. Cameron; and experience has afforded me the fulleſt conviction of its ſafety and efficacy, in all ordinary caſes. During the late epidemic, not a ſingle inſtance occurred to me of the peripneumony ſucceeding the Meaſles, when the bark had been employed. But my aſſiſtance was deſired in the laſt ſtage of fifteen unfortunate caſes of this kind, in which the common antiphlogiſtic and pectoral courſe had been purſued.

(b) Medical Muſeum, Vol. 1. No. 37. p. 281.

The Meaſles, when violent in degree, or ill treated, frequently lay the foundation of hectic fevers, or pulmonary conſumptions. For as the infection is moſt probably conveyed by inſpiration, the lungs become inflamed, a cough enſues, tubercles or a vomica are formed, and the patient ſinks under a lingering, painful, and incurable diſeaſe. To obviate theſe evils, inoculation was propoſed about fifteen years ago, and practiſed in ſeveral inſtances with conſiderable ſucceſs by Dr. Home. The ſoreneſs of the eyes was mitigated by it, the cough abated, and the fever rendered leſs ſevere. His method of communicating the infection was by applying, to an inciſion in each arm, cotton moiſtened with the blood of a patient labouring under the Meaſles *(c)*. But the morbillous matter has ſince been ingrafted by means of lint, wet with the tears, which flow from the eyes in the firſt

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(c) Home's Medical Facts and Experiments.

firſt ſtage of this diſorder. For theſe laudable endeavours to extend the benefits of inoculation, the public is highly indebted to Dr. Home; and it is to be lamented that ſo little attention has been paid to this valuable improvement of the healing art.

The following Table ſhews the annual medium of deaths by the Small-Pox and Meaſles, from 1754 to 1774, compared with the deaths under two years of age by all diſeaſes, and with the general amount of births and deaths during the ſame period of time. It is collected from the printed Bills of Mortality, publiſhed yearly at Mancheſter.

TABLE II.

Years.	Small-Pox.	Meaſles.	Under 2 Years of Age.	Total of Deaths.	Births.
From 1754 to 1758.	64.	21.	209.	651.	678.
to 1764*.	95.	10 .6	213.	639.	731.
to 1769.	98.	9 .6	229.	659.	827.
to 1774.	102.	21 .6	242.	651.	1002.
Total	359.	62 .8	893.	2600.	3238.

THIS Table comprehends ſo long a term of years, that the inferences which it affords would be no leſs indubitable than important, if we could entirely rely upon the accuracy of the *printed Bills of Mortality*. I apprehend, however, that the errors of theſe Bills are not conſiderable;

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* I am not in poſſeſſion of the Bill of Mortality for the year 1760; which is therefore omitted in this Table.

rable; and that the following concluſions, with reſpect to Mancheſter, may be admitted as approaching very near to TRUTH.

I. ONE in *nine*, of all whoſe births are regiſtered at baptiſm, dies of the SMALL-POX; and nearly *one* in *fifty-two* of the MEASLES. It ſhould be obſerved, that the births conſiderably exceed the burials at Mancheſter.

II. THE deaths by the MEASLES are to the deaths by the SMALL-POX, as *one* to *five* and *eight tenths*.

III. THE number dying under two YEARS OF AGE, of all diſeaſes, is to the number baptiſed, as *one* to *three* and *ſix tenths*.

IV. THE number dying under two YEARS OF AGE is to the total number of deaths, as *one* to *two* and *nine tenths*.

V. The deaths by the Small-Pox are to the deaths by all diſeaſes, nearly as *one* to *ſeven* and *a quarter*.

VI. Nearly *three fifths* of thoſe who are carried off by the Small-Pox die under the age of two years (ſee Table I. of the ſmall-pox); and *one* in *four* of all that die under two years of age fall victims to this diſeaſe.

VII. Half of the deaths occaſioned by the Measles happen under two years of age; and the proportion which this number bears to the general deaths, under the ſame period, is nearly as *one* to *twenty-eight*.

Many other very important corollaries may be deduced from this the and preceding Tables; but I wiſh rather to excite than to anticipate the inquiries of the intelligent reader.

Feb. 1ſt. 1775.

ON THE DIFFERENT QUANTITIES OF RAIN WHICH FALL AT DIFFERENT HEIGHTS.

AN ATTEMPT TO ACCCOUNT FOR THE DIFFERENT QUANTITIES OF RAIN, WHICH FALL AT DIFFERENT HEIGHTS, OVER THE SAME SPOT OF GROUND.

IN the laſt volume of the Philoſophical Tranſactions (Vol. 59.) ſome experiments are related, by which it appears, that there fell below the top of a houſe, above a fifth part more rain, than what fell in the ſame ſpace above the top of the ſame houſe; and that there fell upon Weſtminſter Abby, not above one half of what was found to fall in the ſame ſpace, below the tops of the houſes *(a)*. Theſe obſervations, however new and ſingular, are too well authenticated to admit of the leaſt degree of doubt; and philoſophy ſhould be employed not to invalidate a fact ſo fully aſcertained, but to furniſh a rational and adequate cauſe of it.

DOCTOR

(a) I AM informed by an ingenious correſpondent at Bath, that ſimilar experiments have been made in that place, with the ſame reſult; and a friend of mine at Leverpool, on whoſe judgment and accuracy I can rely with confidence, has lately favoured me with the following account, dated March 14th. 1771, "During the late rains, I repeated Doctor Heberden's experiment: the upper veſſel received thirteen ounces and a half of rain, the lower veſſel twenty-ſeven ounces. The difference of altitude was about 16 or 17 yards. The wind blew a briſk gale from the South Eaſt.——I made the trial alſo during a fall of ſnow; and in that, found the proportion as three to five." The following experiment, communicated to me by the ſame gentleman, varies a little in its reſult from the former, owing, perhaps, to a difference in the ſerenity of the air: for the wind has a more powerful effect on the deſcent of ſnow, than of rain, becauſe its ſpecific gravity is leſs. "March 27th. 1771, there was a continued fall of ſnow, from eight

Doctor Heberden conjectures that this phœnomenon depends on ſome property of electricity, which he thinks remains hitherto unknown. To me it appears probable, that the common laws by which this power influences the aſcent and ſuſpenſion of vapours, are ſufficient to explain their precipitation in rain, and

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eight in the morning till five in the afternoon. The air was ſtill; the ſnow came down very thick, and in large flakes. During the nine hours, which the ſnow continued to fall, the upper veſſel received thirteen ounces, the lower veſſel twenty-ſix ounces." In the years 1773 and 1774, the obſervations on the different quantities of rain, which fall at different heights, were repeatedly made at Leverpool. And it was almoſt uniformly found that a veſſel, ſtanding on the ground in a ſpacious garden, received *double* the quantity of rain which fell into another veſſel, of equal dimenſions, placed near the ſame ſpot, but eighteen yards higher. At Middlewich, during part of the year 1774, the quantity of rain received at the top of the church ſteeple was 15,75 inches; and 19 inches in a garden, eighty feet below. The garden, it ſhould be remarked, was not contiguous to, although at no great diſtance from the church.

and the lately diſcovered mode of its deſcent.

The electrical fluid is ſtrongly attracted by water; and by deſtroying the cohesion between its particles, and repelling them from each other, it becomes a powerful agent in evaporation. The waters of the ocean abound in this fire, and vapours raiſed from them float in the air, forming clouds, which retain their electricity till they meet with other bodies, either deſtitute of it, or containing it in a leſs proportion than themſelves *. This, in all probability, is frequently the caſe with thoſe vapours or clouds which are produced by exhalations from the earth, from freſh water, and the perſpiration of plants and trees; at leaſt it is an undoubted fact, that ſome clouds (to uſe the language of this branch of philoſophy) are electrified *poſitively*, and others *negatively*. No ſooner does the communication take place, but the repulſion between the particles of water is diminiſhed, thoſe which have diſcharged part of their electricity are ſucceſſively attracted by the contiguous ones which have not, and thus they preſs nearer together, become ſpecifically heavier than the atmoſphere, and deſcend in ſmall drops, which loſing every inſtant more and more of the electric fire, coaleſce, uniting into larger and larger drops, and conſequently filling a ſpace which is continually diminiſhing, as they approach nearer to the ſurface of the earth. This may be illuſtrated by electrifying the ſtream of a fountain, which will ſpread itſelf into the form of a bruſh by the mutual receſſion of the particles of water: but withdraw the ſupply of electric fire, and the fountain diſcharges itſelf in one continued current *. A pair of

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* Vide Franklin on Electricity.

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* Vide Franklin on Electricity.

cork balls ſuſpended together by ſilken threads, when electrified recede from each other, and if the air be dry, return by degrees only to their natural poſition. Two feathers electrified will float in the atmoſphere, mutually repelling each other, when in a certain degree of contiguity, and gradually deſcending as they loſe that power, which by expanding their *plumulæ*, rendered them ſpecifically lighter than the air. But if one of them diſcharges ſuddenly the electric fire, it will inſtantly be attracted towards the other, and receive a freſh ſupply; when a repulſion (acting indeed at a much leſs diſtance than before) will again take place between them.

When two clouds, one replete with electric fire, the other deſtitute of it, come within the ſphere of each other's attraction, they will ruſh together, and the electrical fluid being diffuſed through a larger ſpace, the particles of water will unite, and form themſelves into drops of greater magnitude, and a heavy ſhower will be produced. Still however as the rain deſcends through an atmoſphere containing little electric fire, it will be continually communicating it, and the diſcharge being greateſt from the circumference of the cloud, becauſe the ſurface is there largeſt, the drops will be drawn nearer and nearer to each other, and approaching towards one common centre, will gradually coaleſce in their paſſage. Doctor Franklin has related a moſt ingenious experiment, which elucidates the formation of rain as thus deſcribed.—— Take two round pieces of paſteboard of two inches diameter; from the centre and circumference of each of them, ſuſpend by fine ſilk threads eighteen inches long, ſeven ſmall balls of wood, or ſeven peas equal in bigneſs; ſo will the balls appending to each paſteboard, form equal equilateral triangles, one ball being in the centre, and ſix at equal diſtances from that and each other; and thus they repreſent particles of air. Dip both ſets in water, and ſome adhering to each ball, they will repreſent air loaded. Dexterouſly electrify one ſet, and its balls will repel each other to a greater diſtance, enlarging the triangles. Could the water ſupported by the ſeven balls come into contact, it would form a drop or drops ſo heavy as to break the coheſion it had with the balls, and ſo fall. Let the two ſets then repreſent two clouds, the one a ſea cloud electrified, the other a land cloud; bring them within the ſphere of attraction, and they will draw towards each other, and you will ſee the ſeparated balls cloſe thus:—The firſt electrified ball that comes near an unelectrified ball, by attraction joins it, and gives it fire; inſtantly they ſeparate, and each flies to another ball of its own party, one to give, the other to receive fire, and ſo it proceeds through both ſets, but ſo quick as to be in a manner inſtantaneous. In their colliſion they ſhake off and drop their water, which repreſents rain. This experiment would better illuſtrate and confirm my *hypotheſis*, if a large number of balls were appended, at equal diſtances, to each paſteboard, ſo as to form ſeveral circles, having one common centre.

But it rarely happens that a land cloud is equal in magnitude to one raiſed from the ſea; conſequently the rain produced by their union, will be proportionably lighter in the upper, and heavier in the lower regions of the atmoſphere, as the electric matter is more or leſs gradually diffuſed.

When an electrified cloud, without mixing with another cloud, or loſing part of its electric fire, becomes ſpecifically heavier than the atmoſphere, by cold, or ſome local change in the denſity of the air, it will deſcend at firſt perhaps in a miſt; but will form, as it approaches nearer to the earth, and is leſs replete with the electric fluid, a light ſhower of rain.

Besides the clouds which float ſeparately in the higher regions of the atmoſphere, the air contains a large quantity of water in the ſtate both of ſolution and of diffuſion; and dews, fogs, and ſometimes even ſhowers of rain, are probably produced by the precipitation of the water thus ſuſpended. Now the quantity of water which the air is capable of diſſolving and ſuſpending, is proportioned to its degree of denſity; and this denſity decreaſes in a certain ratio, according to its diſtance from the ſurface of the earth. Rain therefore in its deſcent will be every inſtant acquiring an acceſſion to the bulk of its drops, by attracting theſe aqueous vapours. For the cold produced by a falling ſhower, will precipitate from the air, both its diſſolved and diffuſed water. And thus at different heights will be produced from this cauſe, ſome difference in the quantity of rain which falls over the ſame ſpot of ground. The diſcharge of the electrical fluid from a falling ſhower, may alſo act as a powerful precipitant of the vapours, which are chemically diſſolved in the air. For by conveying an electrified wire to the ſurface of a quantity of water, ſaturated with any ſaline ſubſtance, an immediate and copious precipitation is produced, and the ſalt forms itſelf into large *flocculi.*

Rain, when undiſturbed by winds, deſcends in lines converging towards the centre of the earth, like the *radii* of a circle. This direction towards the perpendicular, however trifling in degree, gives ſome little tendency to the drops to coaleſce together, and concurs in the general effect of producing a different quantity of rain at different heights.

From what has been advanced it appears probable to me, that the gradual diſcharge of the electrical fire is the principal cauſe of the phœnomenon I have attempted to explain. As the rain deſcends, the drops coaleſce more and more together, by the continued diminution of the repulſive power which counteracted their mutual attraction; and conſequently, in a given ſpace, a much larger quantity will fall near to, than at a diſtance from the ſurface of the earth. A cloud which fills many thouſand acres in the higher regions of the air, when the electric fluid operates upon it with full force, may not cover one third of that extent, when it has deſcended in a ſhower of rain. To this effect the precipitation of the vapours contained in a diſſolved or diffuſed ſtate, in the lower regions of the atmoſphere, and the influence of gravitation in producing a convergency of the drops of rain, will in ſome degree contribute.

POSTSCRIPT.

HAVING communicated the preceding paper to Doctor Heberden and Doctor Watſon, I have been favoured by the latter with the following curious fact.——" The water in the Rain Gage at the top of Lord Charles Cavendiſh and Doctor Heberden's houſes, which are about a mile diſtant from each other, pretty nearly correſpond; but at the bottom of Lord Charles's houſe, though the level is forty feet above the top of Doctor Heberden's, the quantity always exceeds that of Doctor Heberden's. Laſt year, for inſtance, at the top of both their houſes, there were collected about twenty two inches of rain; but in Lord Charles's garden, at a diſtance from any buildings, there fell twenty ſix inches;

and this in his Lordſhip's garden has been conſtant for ſeveral years. Doctor Heberden has been too much confined to make accurate obſervations at the bottom of his late houſe; but he is now removed to Pall Mall, where his opportunities of obſerving are more favourable."

This fact, at firſt ſight, appears to be a ſtrong objection to the *hypotheſis* I have advanced. May it not, however, be obviated by ſuppoſing, that the diſcharge of the electrical fluid from a falling ſhower, is not ſo much influenced by the abſolute, as by the relative height of the places where the rain deſcends? And as the earth may be conſidered as the great recipient and attracter of electrical fire; is it not probable, that the quantity of rain collected, will be proportioned to the diſtance of the receiver from the ground immediately below, and not to its abſolute height, meaſured from any diſtant level, except in ſuch altitudes, where the denſity of the air, and the vapours floating in it, are ſo far diminiſhed as to produce a ſenſible variation? But I offer this conjecture with diffidence; and am ſenſible indeed, that the whole of my attempt to account for the different quantities of rain, which fall at different heights, is liable to objections, becauſe the *data* are yet few upon which it is founded. To promote the ſolution of ſo curious a *phænomenon*, I ſhall here ſubjoin a few queries, propoſed to me by different correſpondents. The fourth ſhould, I apprehend, be reverſed; becauſe it appears probable to me, that trees, plants, water, and moiſt earth, afford more copious exhalations than paved ſtreets, houſes, burning fuel, or the bodies of men.

I. Does a glaſs funnel catch an equal quantity of rain at the ſame height, as a metal funnel; the former being an electric, the latter a non-electric?

II. Is there a difference in the quantity of rain and ſnow catched in ſimilar veſſels, at different heights?

III. Is the difference of rain, catched at different heights, greateſt at the beginning of a ſhower?

IV. Is not this difference greater in large cities, than in the country, owing to the lower regions of the air being more loaded with watery vapours, which have been exhaled by fires, and from the human body?

V. Has the wind no ſhare in producing the diſparity obſerved in the quantities of rain, which fall at different heights?

VI. May not the column of air through which a drop of rain paſſes, in the ſpace of twenty or thirty yards, contain a ſufficient quantity of watery particles, to double the bulk of the drop? This may be illuſtrated by precipitating any ſaline ſubſtance from a ſaturated ſolution of it, contained in a cylindrical veſſel, and examining the proportional quantities of precipitate at different heights. Or, perhaps, it may be determined by the following experiment: Take a cylindrical glaſs veſſel, four inches in diameter, and eight inches high; fill it with ice or ſnow, and place it in a warm room. A watery dew will ſoon be congealed upon its ſurface, which being committed to a nice ſcale, may probably be found to be equal in gravity to a drop of rain. Suppoſe this cylinder to be drawn out to the length of twenty or thirty yards; the ſurface of it will ſtill continue nearly the ſame, though the diameter of it be diminiſhed; and ſuch a tube will aptly repreſent the column of air, through which a drop of rain deſcends, in its paſſage to the earth.

MARCH 30th. 1771.

ON THE SOLUTION OF STONES OF THE URINARY, AND OF THE GALL BLADDER, BY WATER IMPREGNATED WITH FIXED AIR.

ON THE

SOLUTION

OF

HUMAN CALCULI

BY

FIXED AIR.

I FLATTER myſelf that fixed air is now become an object of the attention of Phyſicians; as it has been fully ſhewn that it is capable of being applied to many important medicinal purpoſes. In *pulmonic diſorders*, the *gangrenous ſore throat*, and in *malignant fevers*, the happieſt effects have been experienced from the uſe of it; and I know not a more powerful remedy for *foul ulcers*, as it mitigates pain, promotes a good digeſtion, and corrects the putrid diſpoſition of the fluids. I have related ſeveral caſes, in the ſecond volume of my Eſſays Medical and Experimental, and in the Appendix to Dr. Prieſtley's Treatiſe on Air, which evince the truth of theſe obſervations; and ſince the publication of thoſe works, a variety of ſimilar facts have occurred to my learned friend Dr. Dobſon, in his Hoſpital practice at Leverpool; and to Dr. Rotheram at Newcaſtle upon Tyne.

But I have a farther, and very intereſting diſcovery to communicate, concerning the medicinal properties of this ſpecies of factitious air. About the end of laſt year I was informed that Doctor Saunders, a Phyſician in London, eminent for his knowledge of chemiſtry, had employed it as a ſolvent of the human *calculus*. I was ignorant of the manner in which his trials were conducted, and of the ſucceſs which had attended them;

but my curioſity was excited; the acquiſition of ſuch a remedy was flattering to my hopes; and I engaged in the purſuit of it almoſt with as much ardour, as if it had been the Philoſopher's ſtone. I recollected that Dr. Black and Mr. Cavendiſh have proved the ſolubility of various earthy bodies in water, either by abſtracting from, or ſuperadding to the fixed air which they contain: And as the human *calculus* is diſſolved in the former way by lime water, and the cauſtic alkali; it appeared highly probable that the like effect would be produced, on the ſame ſubſtance, by the latter mode of operation. Analogy ſeemed favourable to the hypotheſis, and experiment has confirmed it.

EXPERIMENT I.

December 13th. 1774. A human *calculus*, in figure and ſize like a Piſtachio nut, of a ſmooth ſurface and firm texture, and which weighed fifty two grains, was ſuſpended in pure ſpring water, ſtrongly impregnated with fixed air, and continually ſupplied with freſh ſtreams of it, by an elegant and well contrived apparatus, lately invented *(a)*. After forty-eight hours maceration, the ſtone was carefully dried, and weighed forty-nine grains and a half. It was become more friable in its texture.

EXPERIMENT II.

ANOTHER *calculus* extracted from the ſame bladder, and ſimilar to the former in figure, texture, and in the ſmoothneſs of its ſurface, was immerſed forty eight hours in a quantity of the ſpring water before employed, not impregnated with fixed air. The weight of the ſtone before immerſion, was forty two grains and

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(a) Sold by Parker, Glaſs-Man, Fleet-ſtreet, London.

and a half; and after it was taken out of the water, and thoroughly dried, forty two grains. The texture and external appearance of it were unchanged.

EXPERIMENT III.

The *calculus* employed in the firſt experiment, and which now weighed forty nine grains and a half, was ſuſpended, during the ſpace of forty eight hours, in an atmoſphere of fixed air, and expoſed to a ſtream of it, at the diſtance of ſeven inches from the effervеſcing mixture of chalk, water, and oil of vitriol. By this operation the *calculus* was rendered much more friable; the *laminæ* of which it was compoſed were looſened, and part of the external one was ſeparated; its colour was changed from grey to white, and when committed to the balance it weighed fifty one grains, having abſorbed a grain and a half of fixed air. By expoſure during the night to the common atmoſphere, the ſtone loſt half a grain of this additional weight, and another half grain afterwards by being laid before the fire.

EXPERIMENT IV.

Three *calculi* were ſuſpended in an atmoſphere of fixed air, and expoſed, as in the laſt experiment, to a ſtream of it, during three days. When put into the veſſel, the firſt was of a yellow colour, and ſolid texture, and weighed two drachms, forty five grains and a half. By the abſorption of fixed air, its gravity was increaſed about the third part of a grain; the colour in certain ſpots was rendered lighter, and thoſe ſpots were ſofter than other parts of the ſtone. The ſecond *calculus* was of a white colour, and cryſtalliſed form, and weighed, before immerſion in the fixed air, two drachms, ſix grains and a half. Its weight, when taken out of the veſſel, was unchanged; but the ſurface of it was become more friable than before. The third ſtone was one drachm, eight grains and a half; was hard, and of a bright colour; and the external *laminæ* of it were broken. It acquired half a grain from the fixed air, and was rendered ſomewhat ſofter and whiter.

EXPERIMENT V.

The *calculi* employed in the foregoing experiment were immerſed three days in mephitic water, conſtantly ſupplied with freſh ſtreams of fixed air, by the apparatus before mentioned. Each ſtone was then thoroughly dried, and expoſed forty eight hours, in damp weather, to the air of my ſtudy, before the weight of it was examined. Number one, the yellow *calculus*, was changed to a very light colour, almoſt approaching to white, and had loſt more than two grains. Number two, was become perfectly white in many parts, was very friable, and had loſt one grain and a half. Number three, was rendered white in various parts; was more friable, and was diminiſhed in weight three grains and a half.

These experiments fully evince, that water, impregnated with fixed air, is a powerful diſſolvent of the human *calculus*. And it is probable that the action of this *menſtruum* would have been conſiderably increaſed, if a proper degree of heat could have been employed. Even the warmth of ſummer might have proved favourable to my trials; which were made in a ſeaſon, when the greateſt height to which the mercury roſe in the thermometer, was the fifty fourth degree of Fahrenheit's ſcale. Lime water has been long and juſtly celebrated as a lithontriptic; but its ſolvent powers appear to be inferior to the artificial mineral water, of which we are now treating. As a proof of this, it may not be improper to relate the following experiment, although it was made on a different occaſion, and is inſerted in a former work *(b)*.

EXPERIMENT VI.

THREE fragments of human *calculi*, numbered for the ſake of diſtinction, one, two, three, were immerſed in equal quantities of different lime waters; the firſt in lime water made with diſtilled water, the ſecond in lime water prepared with hard pump water, and the third in lime water made with the ſame hard pump water, poured, boiling hot, upon the quick lime. Number one, was of a brown colour, and hard texture; was ſmooth on one ſide, and rough on the other;

(b) Treatiſe on Water; Percival's Eſſays Medical and Experimental, Vol. 1. p. 329, ſecond edition.

other; and weighed twenty ſix grains and a half. Number two, was a fragment of the ſame *calculus*, and weighed twenty five grains and a half. Number three, a fragment of a different *calculus*, was of a looſer and more ſpongy texture than the former, and weighed twenty ſeven grains. The phials which contained the *calculi*, and four ounces by meaſure of lime water, were all nearly full, and cloſely corked. After continuing the maceration eight days without heat, the *calculi* were taken out, carefully dried on filtering paper before a gentle fire, and then weighed. Number one had loſt a grain and a half, and was covered in many parts of it with a ſoft, white, cretaceous matter. Number two had loſt only half a grain: many little cryſtals ſhot from its ſurface. Number three had loſt a grain: but it ſhould be remarked that this fragment was much ſofter than the other two.

EXPERIMENT VII.

THREE drachms of the cauſtic alkali, prepared by Mr. Lane, rendered a pint of water ſo pungent, that the tongue and palate could ſcarcely endure the taſte of it. In this liquor were macerated forty eight hours, two *calculi*, one of which weighed a hundred and forty one grains, the other thirty three grains and a quarter. When dried, the firſt ſtone had loſt four grains and three quarters, the *laminæ* of it were ſeparated in many places, and it was covered with a white efflorefcence. The ſecond ſtone ſuffered a diminution in weight of three grains, one of its *laminæ* was ſeparated, and a white efflorefcence alſo appeared on the ſurface of it. The water, impregnated with the cauſtic alkali, was defended from the atmoſphere, during the experiment; but had acquired from the *calculi* ſuch a quantity of fixed air, as to effervesce with the acid of vitriol.

EXPERIMENT VIII.

A SIMILAR experiment was tried with two other *calculi*, which were immerſed during the ſame ſpace of time, in a pint of water ſtrongly acidulated with oil of vitriol. One of the *calculi*, which weighed a hundred and ſixty five grains, was unchanged in its appearance, and diminiſhed in weight ſcarcely half a grain. The other ſtone was rendered very friable, had a white efflorescence in ſeveral parts of it, and was reduced from forty one to thirty one grains.

HUMAN *calculi* vary in their ſtructure and compoſition; and it has been demonſtrated by Dr. Dawſon *(c)*, that ſome

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(c) See the Medical Tranſactions, Vol. 2. p. 105.

ſome of them which are ſoluble in an alkaline, are but little affected by an acid *menſtruum*; whilſt others will reſiſt the action of an alkali, and yet be readily diſſolved by an acid. Even in the ſame ſubject, he obſerves, there may be found *calculi* of oppoſite kinds, ſome of which will diſſolve in acids, ſome in alkalis, and ſome in neither; as from careful and ſufficient trials he judged to be the caſe in a patient of his own. But water impregnated with fixed air, though inferior in efficacy to the vitriolic acid, or the cauſtic alkali, is a more univerſal ſolvent than either of them. For, as far as my obſervations have reached, it acts upon every *calculus* that is ſuſpended in it. And I have tried it with thoſe which have ſuffered no diminution of weight from the *menſtrua* above-mentioned. But a farther detail of my experiments would be no leſs tedious than unneceſſary. And I flatter myſelf that I may now, without incurring the imputation of enthuſiaſm, expreſs the heart-felt ſatisfaction I enjoy, in the diſcovery of a new lithontriptic medicine, that is at once grateful to the palate, ſtrengthening to the ſtomach, and ſalutary to the whole ſyſtem. Lime water often nauſeates the patient, deſtroys his appetite, and creates the heart-burn; and the ſoap ley is ſo cauſtic and acrimonious, that it can be taken only in the ſmalleſt quantity, frequently produces bloody urine, and aggravates the tortures it is intended to relieve. Both theſe remedies alſo require a very ſtrict regimen of diet; and their qualities are liable to be changed either by acidities, or the fermentation of our food in the firſt paſſages. But the mephitic water may be drunk in the largeſt quantity, without ſatiety or inconvenience: It requires no reſtrictions in diet, and its medicinal virtues will be undiminiſhed in the ſtomach or bowels.

Perhaps it may be queſtioned whether fixed air can be conveyed, by the ordinary courſe of circulation, to the kidneys and bladder. In an elaſtic ſtate it certainly cannot; but diſſolved in water, it may paſs through the vaſcular ſyſtem without creating the leaſt diſturbance or diſorder, and by its diuretic quality will be powerfully determined to the urinary organs. So ſtrong is the relation that ſubſiſts between mephitic air and water, that they remain firmly combined, although expoſed to conſiderable variations of heat and cold. Dr. Prieſtley found that it required half an hour, even when the boiling heat was employed, to expel compleatly the fixed air from a phial of impregnated water; and I have obſerved that it has retained its peculiar flavour ſeveral days, when left in a baſon, with a large ſurface open to the external air.

EXPERIMENT IX.

BUT to obtain more ſatisfactory evidence upon this ſubject, I filled a bottle with mephitic air, and placed it in a heat of about ninety eight degrees of Fahrenheit's thermometer. A bent glaſs tube, a quarter of an inch in diameter, properly luted at each end, formed a communication between this bottle and one of lime water; to the bottom of which it extended. An inteſtine motion ſoon enſued; air bubbles were ſlowly conveyed into the lime water; and a white precipitation was gradually formed. In an hour and a half the lime water was become turbid, but was quickly rendered quite milky by blowing air into it from the lungs. The mephitic water ſtill retained its volatile and acidulous taſte; and when a greater degree of heat (108°) was applied to the bottle which contained ed it, a briſk inteſtine motion was renewed.

EXPERIMENT X.

A SMALL quantity of mephitic air, which had been expoſed ten days to the atmoſphere, in a phial uncorked, ſtill retained its acidulous taſte; and when immerſed in water heated to a hundred and forty degrees of Fahrenheit's thermometer, emitted air bubbles very copiouſly. The phial remained in the water till it ceaſed to diſcharge any air; but a very ſlight agitation again renewed the inteſtine motion; and it rendered lime water, when mixed with it, as white as milk.

THE judicious writer, to whoſe uſeful paper I have before referred, has recommended an attention to the fragments, ſcales, or films, which the ſtone in the kidneys or bladder may caſt off, and alſo to the contents and ſediment of the urine; that a diſcovery may be made whether the proper ſolvent be an acid, or an alkaline *menſtruum*. If it appear to be the former, the elixir of vitriol may be uſed in conjunction with mephitic water, to which it will be no ungrateful or inſalutary addition. And there is reaſon to believe that this acid may be conveyed to the kidneys, without any conſiderable change in its properties. It is not ſubject to fermentation, and is diſpoſed to paſs off by urine. The ſucceſsful exhibition of it in the itch, ſeems to evince, that it is capable of being received into the vaſcular ſyſtem, and of being excreted, probably in a volatiliſed ſtate, by the pores of the ſkin. Even when given to nurſes, labouring under this complaint, it is ſaid both to cure them, and the children which they ſuckle *(d)*.

As

(d) Vide Diſſertationem de olei vitrioli uſu in quibuſdam

As the vapour of chalk and oil of vitriol has been found ſo efficacious in correcting the *ſanies*, and abating the pain of foul ulcers, when externally applied; we may reaſonably preſume that the internal uſe of the ſame remedy will prove beneficial, in ſimilar affections of the urinary paſſages. Such complaints frequently occur in practice, and may ariſe, either from *calculi* in the kidneys and bladder; from the receſſion of ſcorbutic eruptions which appeared on the ſurface of the body; from the venereal diſeaſe; from ſtrains, contuſions, or various other cauſes. And water impregnated with fixed air ſeems well adapted, by its diuretic, healing, and antiſeptic powers, to waſh off and ſweeten the acrid matter, to abate the defluxion on the mucous membrane, to contract the flabby edges of the ulcers, and to diſpoſe them

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buſdam Scabiei ſpeciebus. 1762. Medical and Philoſophical Commentaries, Vol. 1. p. 103.

them to a ſpeedy granulation. If the pain, inflammation, and abſorption of the *pus* have excited a hectic fever, the patient may drink plentifully of Seltzer water, which is of a cooling quality, although it abounds with mephitic air; or a ſmall quantity of Rochelle ſalt may be added to the mineral water artificially prepared. Thus will the increaſed action of the heart and arteries, which may ariſe from the ſtimulus of the fixed air, be entirely obviated, without the leaſt diminution of its medicinal powers. And whilſt the ſanction of experience is wanting, reaſon will juſtify the trial of a remedy, which is at once ſafe, pleaſant, and efficacious.

In ulcers of the kidneys and bladder, the urine is commonly high coloured, pungent, and of an offenſive ſmell. To aſcertain whether fixed air would correct theſe qualities, I attempted the following diſagreeable experiment.

EXPERIMENT XI.

Repeated ſtreams of fixed air were conveyed into three pints of urine, which had been kept till it was become very putrid, and which emitted a ſtrong, volatile odour. I examined the ſmell of it from time to time, whilſt this proceſs was carrying on, and compared it with a portion of the ſame urine, which was reſerved as a ſtandard. The pungency of it gradually abated, it acquired a brighter colour and was leſs turbid, but its putrid odour ſeemed to be increaſed. Theſe obſervations were made in the evening, and early the next morning I awoke with a violent head ach, which was attended with vomiting and a diarrhœa. Alarmed at theſe effects, which I attributed to the putrid vapours of the urine, I dropt the proſecution of the experiment; but the ſucceeding day, Mr. Thomas Smith, a young gentleman who will one day be an ornament to the profeſſion of phyſic, undertook the examination which I had begun: And after attentively comparing the ſtandard and the urine impregnated with fixed air, he found the latter more offenſively putrid than the former, but without any degree of pungency, or volatility. As this experiment was not compleated, I am uncertain whether the urine was ſweetened by the mephitic air. But it is evident that the volatile alkali, generated by putrefaction, was either neutraliſed, diſſipated, or prevented from aſcending, by the atmoſphere of fixed air, which filled the other part of the veſſel. Perhaps this atmoſphere might be the *menſtruum* of the putrid *effluvium* emitted by the urine, which being then accumulated, would appear to have its *fœtor* increaſed. In another work, I have related an experiment made by my friend Mr. Henry, ſomewhat ſimilar to this, and which ſuggeſted to him the like explanation.

A piece of putrid fleſh was ſuſpended twelve hours in a three pint bottle, cloſely corked, and filled with fixed air, which had been ſeparated from chalk by the vitriolic acid. The beef was conſiderably ſweetened, but the air in the bottle was rendered intolerably offenſive.

THE waters of Bath, in Somerſetſhire, have been long and juſtly celebrated for their efficacy in the jaundice and other hepatic diſorders. They abound with fixed air; and it may be of importance to aſcertain whether they derive from this active principle, the power of diſſolving the concretions of the bile, and of removing the obſtructions in the liver. I was induced therefore to try the ſolubility of gall ſtones in mephitic water. But I have yet, only a ſolitary experiment on the ſubject, to offer to the reader.

EXPERIMENT XII.

A GALL ſtone, that had been extracted from a tumour in the region of the liver, was divided into two parts. One of theſe, which weighed fifty one grains and a half, was immerſed four days in rain water, ſtrongly impregnated with fixed air. The other weighed twenty grains and a quarter, and was macerated in ſimple rain water during the ſame ſpace of time. The firſt fragment, when carefully dried, was become heavier by one grain, having gained ſo much from the fixed air. In texture and appearance it remained unchanged. The ſecond fragment had loſt one eighth of a grain.

I MEAN not to draw any deciſive inference from a ſingle experiment: But it is probable that the Bath waters reſolve concretions of the bile, not ſo much by a chemical operation, as by accelerating the ſecretions of the liver, ſtimulating the organs of digeſtion, and invigorating the whole animal ſyſtem. Nature indeed obſerves a peculiar œconomy in the circulation of the blood through the liver; and as the bile is one of her moſt elaborate fluids, it muſt be difficult to introduce a foreign and unaſſimilated ſubſtance into it. From analogy however we may conclude, that this is not impracticable. The milk and the ſaliva are frequently impregnated with adventitious matters; and theſe animal liquors, like the bile, are ſecreted by organs of a particular ſtructure, and for determinate and important purpoſes. A remedy which would paſs unchanged into the ſyſtem of the liver, and medicate the bile ſo as to render it unapt to coagulate, or enable it to reſolve the concretions already formed, would be a moſt valuable acquiſition *(e)*. And the obſtacles to the

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(e) Vide Medical Tranſactions, Vol. 2. p. 165.

the attainment of it ſhould rather be regarded as incitements to our induſtry, than apologies for ſupineneſs and deſpair. Such, it muſt be acknowledged, they have proved; as appears from the variety of diſſolvents which have been propoſed, and tried. Acids, alkalis, ſoap, ardent and dulcified ſpirits, with freſh vegetable juices, have been recommended. Valiſnerius found that a compoſition of alcohol and oil of turpentine deſtroyed the texture and coheſion of gall ſtones, more perfectly than any other *menſtruum (f)*; and Mr. William White of York has fully confirmed this obſervation, by a number of judicious experiments which he has communicated to me. Some time ago I thought favourably of this remedy, and endeavoured to promote the trial of it *(g)*; but farther reflection has convinced me that the continued uſe of it

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(f) Opere, Tom. 3. p. 6.

(g) Eſſays Medical and Experimental, Vol. 2. p. 232.

it is more likely to prove injurious than beneficial. Spirituous liquors, of all ſorts, have a peculiarly unfavourable operation on the liver; and it would be abſurd to ſeek a *ſpecific medicine* for the diſeaſes of the bile, in what experience has fatally ſhewn to be a *ſpecific poiſon* to the organ which ſecretes it. Perhaps fixed air, under ſome form or other, may hereafter be found to be the *deſideratum* which we have been ſo long purſuing. At leaſt we may be allowed to attribute ſome ſhare of the virtues which the Bath waters poſſeſs, to this ingredient in their compoſition; and when they cannot be employed, to recommend the mephitic water, as an innocent and efficacious ſubſtitute.

EXPERIMENTS

AND

OBSERVATIONS

ON THE

NATURE AND COMPOSITION

OF

URINARY CALCULI.

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URINARY CALCULI.

A CALCULUS, extracted from a young man about two years ago, by my friend Mr. Charles White of Mancheſter, had ſo much the appearance of chalk, that I was induced to make ſome experiments upon it. The *nucleus* was a bougie, which had unfortunately paſſed into the bladder; and a ſtone, of a conſiderable ſize, had been formed in leſs than twelve months.

EXPERIMENT I.

A FEW grains of this *calculus* produced a ſtrong effervefſcence with thirty drops of oil of vitriol, and half an ounce of water. Thirty eight grains of it were calcined in a crucible, placed two hours in a wind furnace; and to this *calx* which weighed twenty four grains, were added five ounces of water. The water acquired a ſlight impregnation of quick lime; and after filtration depoſited a ſmall ſediment, when a ſtream of fixed air was conveyed into it.

EXPERIMENT II.

IN the laſt experiment the portion of the *calculus* employed was probably too ſmall, to give more than a ſlight impregnation to ſo many ounces of water. Another ſtone therefore of a white colour,

lour, but which did not efferveſce with oil of vitriol, was calcined in the ſame furnace during the ſpace of *three hours*. By this proceſs the *calculus* was reduced in weight from three hundred and nine, to ninety two grains; and though the ſolid particles ſcarcely impreſſed the tongue with any ſenſe of cauſticity, yet they communicated to five ounces of water, a very ſtrong taſte of quick lime; and the filtered liquor became milky by blowing air into it from the lungs, and ſoon depoſited a large white ſediment.

EXPERIMENT III.

A THIRD *calculus*, of a cloſe texture and red colour, which did not efferveſce with ſpirit of vitriol, and weighed ſeven drachms and a half, was put into the crucible, and in a few hours was entirely conſumed by the fire.

EXPERIMENT IV.

A FOURTH *calculus,* in figure like a mulberry, and which did not effervefce with the vitriolic acid, was calcined three hours, and loſt more than three fifths of its weight by this proceſs. It taſted very acrid, and made a ſtrong lime water.

EXPERIMENT V.

A FIFTH *calculus* which weighed two hundred and forty five grains, before calcination, was reduced to thirty grains by this operation; and the remaining powder was taſteleſs, and gave no impregnation to water.

FROM theſe experiments we may conclude that an abſorbent earth often enters into the compoſition of the urinary *calculus.* For it is the peculiar property of this claſs of bodies to be convertible into quick lime, by the action of fire. It does not ſeem probable that this ſubſtance is the product of animalization, in the human ſpecies. The ſhells of ſea fiſhes and of ſnails furniſh it indeed in large quantity; but the bones, horns, blood, ſkin and fleſh of animals, however ſtrongly calcined, are not changeable into lime. Mr. Rouelle has lately diſcovered the fixed alkali in the ſerum of the blood; and Dr. Lewis has obſerved that the aſhes of fleſh, and blood are readily, perfectly, and plentifully ſoluble in the mineral acids; and that they form with them an auſtere, aſtringent liquor, approaching to an aluminous nature.(a) The human *calculus* muſt therefore be conſidered as an heterogeneus ſubſtance, conſiſting of thoſe recrementitious parts which are ſeparated from the blood by the kidneys. Whether theſe parts differ eſſentially in different conſtitutions, or whether they vary only in the proportion which they bear to each other, is a point of difficult ſolution. I am inclined to adopt the latter ſuppoſition; but however this may be decided, I think it is very evident that *calculi* of the kidneys and bladder are not of animal origin alone, as they frequently contain an abſorbent earth, which is not generated in the human body. This ſubſtance muſt therefore be conſidered as adventitious, and is probably conveyed into the ſyſtem by the uſe of HARD SPRING WATER, in which it commonly abounds. In a former work, I pointed out the pernicious effects of ſuch waters, in habits which are ſubject to the ſtone and gravel. But influenced by the moſt reſpectable authorities, *(b)* I then believed that the *calculi* of the urinary organs, partake not in the leaſt of a foſſil nature; and that their formation depends either upon ſome accidental

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(a) Lewis's Tranſlation of Newmann's Chemiſtry, p. 494.

(b) HIST. de l'Acad. Royale des Scienc. 1700. Perrault Vitruve. lib. 8. c. 5. Medical Tranſactions, Vol. 1. p. 7. Sharp's Surgery, p. 75.

tal *nucleus*, or upon a peculiar, and often hereditary diſpoſition to concrete in the animal fluids. Hence I ſuppoſed that impure waters were only *negatively* favourable to this diſpoſition, by having no tendency to diminiſh it. For water, whether uſed as nature preſents us with it, or mixed with wine, or taken under the form of beer or ale, is the great diluter, vehicle, or ſolvent, both of our food, and of the ſaline, earthy, and ſuperfluous parts of the animal juices. And it is more or leſs adapted to the performance of theſe offices, in proportion to its degree of purity; becauſe a *menſtruum* already loaded, and perhaps ſaturated with different contents, cannot act ſo powerfully, as one which is free from all ſenſible impregnation. (*c*) But as an abſorbent earth is found (Exp. I. II. IV.) to be often a component part of the human *calculus*, I am now convinced that

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(*c*) Percival's Eſſays Medical and Experimental. Vol. I. 2d Edit. p. 282.

hard waters actually contribute to the formation of it. This is an opinion which the father of phyſic advanced, and which till lately has remained uncontroverted by his followers. *Damnantur imprimis fontes,* ſays Pliny, *quorum aquæ decoctæ, craſſis obducunt vaſa cruſtis.* *(d)* It was obvious indeed to infer that waters which depoſite a large earthy ſediment, either in the aquæducts through which they are conveyed, or in the veſſels in which they are boiled or preſerved, would let fall their groſſer particles in paſſing through the kidneys, and eſpecially whilſt retained in the bladder; and that theſe by the continued appoſition of freſh matter, connected by the animal *gluten,* and compacted by the action of thoſe organs, would form the ſtone or gravel. But the ſeparation of earthy matter in the urinary paſſages may be better explained by the chemical doctrine of affinities. For the vitriolic

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(d) Lib. 31. c. 3.

vitriolic acid contained in *ſelenites*, with which hard ſpring waters are uſually impregnated, will forſake its baſis, and combine with the alkaline ſalts, ſo copiouſly diſcharged by thoſe excretories.

THAT the ſtone, though it is by no means a rare diſorder, does not more frequently occur in this country, which abounds with calcareous waters, is a difficulty which I muſt acknowledge myſelf at a loſs to obviate. But it may be remarked that internal affections of the human body are ſeldom produced by a ſingle cauſe; and the concurrence of many may be neceſſary to form a *calculus* in the bladder. *(e)* This malady however is ſcarcely known in Switzerland, as I have lately been informed by a letter from Baron Haller. And the ſprings of that Alpine region are remarkably light, pure, and free from all mineral ingredients.

(e) Raro tamen ſimplex eſt, ſed plerumque ex pluribus conditionibus una concurrentibus compoſita. Gaubij. Pathologia. Sect. 68.

In the ſecond and fourth experiments related above, the *calculi,* though they contained an abſorbent earth, did not efferveſce with the vitriolic acid. This muſt be aſcribed to the glutinous matter, in which the earthy particles were involved, and by which they were defended from the powerful action of the *menſtruum* employed.

April 1, 1775.

A
LETTER
TO
MR. JOHN AIKIN,
ON THE
INTERNAL REGULATION
OF
HOSPITALS.

To Mr. AIKIN.

Mancheſter, October 1, 1771.

Dear Sir,

I HAVE peruſed with great pleaſure your ingenious Thoughts on hospitals. The importance of the ſubject, and the judicious manner in which you have treated it, cannot fail to excite the attention, and to ſecure to you the approbation of the public. It is a melancholy conſideration, that theſe charitable inſtitutions, which are intended for the health and preſervation of mankind, may too often be ranked amongſt the cauſes of ſickneſs and mortality. *(a)* This obſervation you

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(a) A third of all who die at Paris, die in hoſpitals. In the *Hotel Dieu*, a great hoſpital ſituated in the middle

you have well illuſtrated, by pointing out the pernicious effects of tainted air; the falſe œconomy of crowding a number of ſick perſons into as little ſpace as poſſible;

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middle of that city, we behold a horrid ſcene of miſery; for the beds being too few for the numbers admitted, it is common to ſee four, ſix, or even eight patients in a bed together, lying four at one end, and four at the other. The number annually admitted into this hoſpital amounts to near twenty-two thouſand; (vid. Police of France, p. 83), and I am well informed that *two* in *nine*, of all received from 1724, to 1763, have died. In the two great hoſpitals of London, St. Thomas's and St. Bartholomew's, about ſix hundred die annually, or *one* in *thirteen* of all admitted as in-patients. Vid. Price on the Expectation of Lives, p. 216. In the Northampton infirmary *one* in *nineteen* of the in-patients *(communibus annis)* dies every year; and in that of Mancheſter, which is built in an airy ſituation, and tolerably well ventilated, *one* in *twenty-two*. This proportion of deaths, I apprehend, exceeds the mortality which occurs in private practice: And it will appear to be more conſiderable, when we recollect that, beſides the patients who are diſmiſſed as incurable, improper objects, or on account of irregularity, the event of whoſe caſes remains unknown, the ſmall pox, meaſles, lues venerea, fevers, and other dangerous and fatal diſtempers, are excluded from admiſſion into theſe hoſpitals.

poſſible; and the miſtaken humanity of admitting patients, who labour under diſeaſes which are contagious in their nature, incapable of relief, or liable to be aggravated by confinement in an impure atmoſphere.

But as ſo many infirmaries are erected in different parts of the kingdom, on plans which cannot now be altered; and as they are governed by eſtabliſhed laws which, however erroneous, will ſtill, from the force of cuſtom, continue to be obſerved, it were to be wiſhed, that ſome means could be deviſed of obviating the inconveniences which ariſe from their preſent conſtruction, as well as mode of regulation. Permit me to ſuggeſt to you a few hints on this ſubject, which I ſhall hope to ſee improved and enlarged, if they fall within the deſign of your uſeful publication.

Air, diet and medicine, are the

three great agents to be employed, in preventing and correcting putrefaction and contagion in hoſpitals. A gallon of air is conſumed every minute by a man in health; a ſick perſon requires a larger ſupply, becauſe he more quickly contaminates it; and it is obſerved that animals expire ſooner in foul air, than in vacuo. Beſides ventilators therefore, and ſaſhes ſliding downwards ſo as to open at top, apertures ſhould be made in the wall oppoſite to the windows, correſponding to them in number, and of ſufficient dimenſions. This is an improvement lately adopted in the infirmary at Leiceſter, and has been found to ſucceed. The larger wards ſhould have a fire-place at each end of them; and if the fly of a ſmoke jack were to be fixed in every chimney, it would accelerate the current or air through them. In ſummer time, this diſcharge of foul air by the pipes of the chimney, may be continued by means of a flue, communicating with a fire below.

ſow. I ſhould not omit to mention, that the ſalubrity of the air is very much influenced by its temperature, which ought to be regulated by a thermometer, placed in the centre of every room.

But ſupplies of the pureſt air are inſufficient to deſtroy contagion; of which I could produce ſeveral undeniable proofs, from the beſt authority. It is neceſſary therefore to correct the noxious effluvia which ariſe from ſo many diſtempered bodies, afflicted perhaps with mortifications, carious bones, malignant ulcers, or putrid fevers. This I apprehend may be effected by ſprinkling, or rather waſhing daily the apartments of the ſick with vinegar and an infuſion of dale ſaw-duſt, or with oil of vitriol and water; by frequently fumigating them with the ſteams of boiling vinegar and tar; or if diſeaſes of extraordinary malignancy occur, with boiling vinegar, myrrh, and camphor; by uſing wood fuel, particularly fir, and occaſionally dipping the faggots in tar; by ventilating the bed cloaths of ſuch patients as are able to ſit up or walk about, and afterwards impregnating them with the antiſeptic vapours above mentioned; and by obliging the ſick to conform ſtrictly to the rules of nicety and cleanlineſs. If any of them have been accuſtomed to ſmoaking, they ſhould be allowed pipes and tobacco, when ſuch an indulgence will not be injurious to them. The patients ſhould have their linen very frequently renewed, and their ſhirts and ſheets ſhould be fumigated with frankincenſe, before they are uſed. The dreſſings of foul ulcers, &c. as ſoon as they are removed, ſhould be thrown into veſſels of vinegar, or of oil of vitriol and water, and carried out of the wards with all convenient expedition. It is to be wiſhed that ſalves were baniſhed from hoſpital practice; and I rejoice that, in a former work, you have ſo ſtrongly expreſſed your diſapprobation of them.

them *(b)*. Oil, by heat, acquires a rancidity which renders it both ſtimulant and ſeptic, and by theſe qualities it increaſes the acrimony and fœtor of all purulent diſcharges. Poultices either of carrots or white bread, or tow lightly ſpread over with the mucilage of ſtarch, mixed with ſuch a proportion of neats-foot oil as to prevent its growing ſtiff, might perhaps be uſefully ſubſtituted, as ſoft defenſatives in the room of plaſters and cerates. Twelve parts of the mucilage, and one of oil mix uniformly together without heat, are of a due conſiſtence, and continue moiſt a ſufficient length of time. In ſome caſes it may be of advantage, to prepare the mucilage of ſtarch with the ſaturnine water of Goulard; which with the neatsfoot oil, will furniſh an emollient, antiſeptic, and moderately aſtringent topic, much ſuperior,

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(b) Obſervations on the External Uſe of Preparations of Lead.

perior, I apprehend, to the *unguentum tripharmacum.*

Next to the ſalubrity of the air, a well-regulated diet may be conſidered as the moſt powerful preſervative againſt the in-bred diſeaſes of hoſpitals. In ſummer and autumn, when putrid diſtempers are moſt prevalent, the patients ſhould be liberally ſupplied with fruit. Nor will the procuring of it be attended either with difficulty or expence, if it be intimated to the patrons of theſe charities, and to other well-diſpoſed perſons, that ſuch donations will be highly acceptable.

Rice forms a conſiderable article in the table of diet, of almoſt every infirmary. But as a wholeſome aliment it is much inferior to ſalep, which I believe is ſeldom if ever uſed. I digeſted ſeveral mixtures, prepared of mutton and water, beat up with bread, ſea biſcuit, ſalep, rice flour, ſago powder, potatoe, old cheeſe, &c. in an heat equal to that of the human body. In forty-eight hours they had all acquired a vinous ſmell, and were in briſk fermentation, except the mixture with rice, which did not emit many air bubbles, and was but little changed. The third day ſome of the mixtures were ſweet, and continued to ferment; others had loſt their inteſtine motion, and were ſour; but the one which contained the rice was become putrid. From this experiment it appears that rice, as an aliment, is ſlow of fermentation, and a very weak corrector of putrefaction: It is therefore an improper diet for hoſpital patients. Nor can it be conſidered as a very nutritive kind of food, on account of its difficult ſolubility in the ſtomach. Experience confirms the truth of this concluſion; for it is obſerved by the planters in the Weſt Indies, that the negroes grow thin, and are leſs able to work, whilſt they ſubſiſt upon rice.

Salep is ſaid to contain the greateſt quantity of vegetable nouriſhment under the ſmalleſt bulk; and from its reſtorative, mucilaginous, and demulcent qualities, it deſerves to be conſidered as a *medicinal diet*. It obtunds the acrimony of the fluids, and at the ſame time is eaſily aſſimilated into a mild and wholeſome chyle. In diarrhœas, and in the dyſentery, it is highly ſerviceable, by ſheathing the internal coat of the inteſtines, by abating irritation, and gently correcting putrefaction. In the ſymptomatic fever, which ariſes from the abſorption of pus, from ulcers in the lungs, from wounds, or from amputation, ſalep uſed plentifully, is an admirable demulcent (c).

(c) Vide Percival's Obſervations on the Orchis Root, Georgical Eſſays, Vol. IV. Eſſays Medical and Experimental, Vol. II.

Cheese, I apprehend, is an unwholeſome diet for convaleſcents, becauſe when new it is almoſt indigeſtible; and although when mellowed by age, I have obſerved that it ferments readily with fleſh and water, yet it ſeparates a rancid oil, which ſeems incapable of any further change, and as a ſeptic muſt be pernicious. For hoſpital patients are ſo liable to relapſes, that the ſlighteſt error of diet may occaſion them. The infuſion of malt, which is ſtrongly recommended in the ſcurvy at ſea, may perhaps, as an antiſeptic, be no leſs uſeful in hoſpitals. It may be allowed the patients for common drink, in lieu of table beer, which having undergone the vinous fermentation, has loſt in ſome meaſure the power of correcting or ſweetening putrefaction. Should this liquor prove too aperient, a few red roſe leaves, or balauſtines, infuſed with the malt, will obviate this effect, without communicating any diſagreeable flavour. The flour of malt might alſo be employed for making gruel, milk pottage, or puddings.

With reſpect to animal food, all ſalted and ſmoke dried meats are, I believe, generally diſallowed. Pork ſhould likewiſe be forbidden, as it is the moſt putreſcent kind of fleſh, and tends to diminiſh perſpiration. Care ſhould be taken alſo, that the meat which is killed for the uſe of infirmaries, be more than uſually blooded, that it may not by becoming ſoon tainted, concur with other unavoidable cauſes, in the production of putrid diſeaſes.

Concerning medicines little more can be ſuggeſted, than that in preſcribing them, regard ſhould be had not only to the preſent ſymptoms, but alſo to the putrid tendency, and contagious nature of hoſpital diſeaſes. And as the courſe of infection is uſually ſlow, the phyſician ſhould carefully watch its firſt acceſſion, and by ſuitable remedies inſtantly check its progreſs.—In malignant fevers, beſides adminiſtering the Peruvian bark in ſubſtance or decoction, a light infuſion of it, well acidulated, may be directed for the common drink of the patient. But in leſs urgent caſes, vinegar, or cream of tartar whey will be a more grateful diluent, and ſufficiently antiſeptic. It would be a farther means of correcting putrefaction, and would anſwer other uſeful purpoſes, if the ſick were to waſh their faces, and bathe their feet and hands every morning and evening, in a decoction of bark, or of chamomile flowers, mixed with vinegar.

I HAVE thus, my dear friend, very imperfectly drawn the outlines of a plan for rendering hoſpitals upon their preſent eſtabliſhment, more ſalutary to the ſick, and conſequently more uſeful to the public; and I flatter myſelf you will improve and finiſh it. Permit me, before I conclude, to mention an ingenious contrivance, uſed in the infirmary at Leiceſter, which contributes greatly to the eaſe and convenience of the patients. The bed-ſteads, which are of iron painted, are ſo made, that the backs, by means of a ſcrew, may be raiſed or lowered, with the greateſt facility. This improvement was ſuggeſted by Dr. Vaughan, and executed under the direction of Dr. Aſh at Birmingham.

I am with ſincere Eſteem and Friendſhip,

DEAR SIR,

Your faithful, affectionate,

and moſt obedient Servant,

THOMAS PERCIVAL.

EXPERIMENTS

AND

OBSERVATIONS

ON THE EFFECTS OF

FIXED AIR,

ON THE

COLOURS AND VEGETATION

OF

PLANTS.

EXPERIMENTS AND OBSERVATIONS ON THE EFFECTS OF FIXED AIR, ON THE COLOURS AND VEGETATION OF PLANTS.

THE influence of fixed air on vegetation is a new, curious, and very intereſting object of inquiry. I was led into it, by a train of experiments, which the following paſſage, in Doctor Prieſtley's Obſervations on Various Kinds of Air, ſuggeſted to me. " A red roſe, freſh gathered, loſt its redneſs, and became of a purple colour, after being held over fermenting liquor about twenty-four hours; but the tips of each leaf were much more affected than the reſt of it. Another red roſe turned perfectly white in this ſituation; but various other flowers, of different colours, were very little affected. Theſe experiments were not repeated, as I wiſh they might be done, in pure fixed air, extracted from chalk by means of oil of vitriol."

March 16th, 1775. I EXPOSED a tulip, forty-eight hours, to a ſtream of fixed air, ſeparated from chalk by means of oil of vitriol. The colours and odour were preſerved unchanged; the leaves were curled at the edges, but remained firm and undecayed. Another tulip, gathered at the ſame time, from the ſame root, and ſimilar in colour, ſoon became faded, flaccid, and loſt its odour in the common atmoſphere.

The ſame experiment was made with a purple crocus; with a white and yellow jonquil; with the hepatica; with a polyanthus of a purple hue; and with a ſtock July flower. They were all perfectly preſerved in the veſſel of fixed air; whilſt ſpecimens of the ſame flowers ſpeedily loſt their bloom, and turned ſoft and ſhrivelled in the open air.

The Italian Narciſſus, a delicate flower, which grew in a hot houſe, retained its colours forty-eight hours in the fixed air; but the petals (or leaves of the flower cup) were very much contracted.

A pale red roſe, taken from a hot houſe, was expoſed twenty-four hours to a ſtream of fixed air, without ſuffering any change of colour. It was carefully compared with another roſe, collected from the ſame tree *(a)*.

The

(a) Mr. Henry expoſed ſeveral red roſes, in the ſummer of 1774, to a ſtream of pure fixed air, and did not

The reſult of this experiment differs from that related by Dr. Prieſtley. But it is probable, that the fixed air, ſeparated from fermenting liquors, is leſs pure and unmixed than that obtained from chalk by the addition of oil of vitriol; and that its effects may be varied by the adventitious matters with which it is combined.

The preſervation of flowers by mephitic air was an event which I little expected, at the commencement of theſe trials. And as an active mind is ſeldom ſatisfied with the bare obſervance of effects, without inquiring into the cauſes which produce them, I was naturally led into a train of reaſoning on this curious ſubject. It was well known to me, that vegetables, before the putrid fermenta-

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not find any change produced in their colour. See his excellent tranſlation of Lavoiſier's Eſſays Phyſical and Chemical, which he has enriched with various uſeful notes, page 130.

tion begins, emit a very large proportion of fixed air (*b*). But this ſeparation can only take place by the mediation of ſome body, which is capable of carrying off what is diſcharged. A wet ſpunge will never become dry in an atmoſphere ſaturated with moiſture; and red hot wood ceaſes to burn in inflammable air, which is already loaded with phlogiſton. I was induced, therefore, to ſuppoſe, that the flight of mephitic air from flowers, which ſeems to conſtitute the firſt ſtage of their decay, is prevented or conſiderably retarded by ſurrounding them with the ſame ſpecies of air, and by excluding from them the common atmoſphere, its proper vehicle (*c*).

But the proſecution of my experiments diſcovered to me, that fixed air not

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(*b*) See Prieſtley's Obſervations, Vol. I.

(*c*) See this ſubject, ſo far as it relates to putrefaction, farther illuſtrated in the ſecond volume of theſe Eſſays, page 84.

only retards the decay, but actually continues the vegetation of plants, and affords them a *pabulum*, which is adequate to the ſupport of life and vigour in them for a conſiderable length of time.

Tueſday. A SPRIG of MINT was ſuſpended, with the root upwards, in a veſſel of fixed air. The ſucceeding day it was as freſh and verdant as when firſt gathered. Another ſprig, collected at the ſame time and from the ſame bed, which lay upon my table, was quite withered. Friday, the fourth day, a curve was formed in the middle of the ſtalk, and the top of the ſprig had riſen about an inch perpendicularly towards the mouth of the veſſel. Saturday, the mint continued to grow and to aſcend, looking vigorous and freſh: the root, which was very ſmall, appeared quite dry, ſo that the nouriſhment, probably, was imbibed by the leaves. Tueſday, having been abſent two days, the plant was not ſupplied with freſh ſtreams of air: it was ſtill in vigorous vegetation. Friday, the eleventh day of the experiment, the plant was taken out. It was perfectly freſh, but whilſt it lay on my ſtudy table the leaves grew ſoft and flaccid, and in leſs than ſix hours it ſeemed to be withered. The mercury in Fahrenheit's thermometer, during the courſe of this experiment, ſtood from 60 to 69 degrees in the ſhade and open air, at two o'clock in the afternoon.

March 23d. TWO SPRIGS of MINT with their roots, freſh gathered from the ſame bed, and nearly alike in ſize, were each put into a half ounce phial, filled with rain water. One of them was ſuſpended four days and an half in a veſſel of fixed air, and frequently ſupplied from chalk and oil of vitriol with freſh ſtreams of it. The other was placed near it, in the common atmoſphere of my ſtudy. And a few ſprigs of mint, with their roots, were at the ſame time laid upon the table. The latter withered in about twelve hours; and in twenty-four hours were dry and quite ſhriveled. The ſprig in the fixed air flouriſhed greatly; ſhot out freſh leaves from the part immediately above the neck of the phial; expanded its leaves; looked verdant; and when taken out of the fixed air, had gained in length more than half an inch. The ſprig in the common atmoſphere looked ſickly; the leaves were contracted, had a brown and curled appearance, and ſeveral of them were become dead and rotten.

March 28th. The flouriſhing ſprig of mint, which had been ſuſpended in the fixed air, was now placed in the common atmoſphere of my ſtudy; and the other which was ſo much faded, was put into the veſſel of fixed air. In two hours time the leaves of the former began to droop and grow flaccid, like a plant taken from a hot-bed; and in twenty-four hours they were in a withered ſtate. The latter ſprig was much revived by the fixed air; but did not vegetate in nearly ſo vigorous a manner as the firſt had done. It was kept four days in the veſſel, and daily furniſhed with freſh ſupplies of fixed air.

April 1ſt. The water, in which the ſprig of mint grew that had been ſuſpended in fixed air, became impregnated with this active principle, as appeared from its acidulous taſte, and from its producing an inſtant precipitation when mixed with lime-water. This incited me to try how a plant would vegetate in mephitic water, with its leaves and branches expoſed to the common atmoſphere. A ſprig of mint was, therefore, put into a phial, containing about ſix ounces of it. The ſtalk paſſed through a perpendicular groove, cut in a cork, which ſtopped the mouth of the bottle, to prevent the eſcape of the fixed air. In two days the leaves of the mint became curled at the edges; and the plant ſeemed to be in a leſs thriving ſtate, than another ſprig of mint placed in rain water, which ſerved as a ſtandard. Suſpecting that the ſtalk of the mint was compreſſed and injured by the cork, I renewed the experiment, uſing freſh ſprigs of mint, and other portions of water; and leaving the mouth of the phial, which held the mephitic water, open to the external air. The vegetation of the plant, in this water, was now very vigorous; and the growth of it, in ſix days, conſiderably exceeded that of the ſtandard.

April 8th. The experiment of March 23d was repeated; and the ſprig of mint, placed in a phial containing half an ounce of rain-water, and ſuſpended in a veſſel conſtantly ſupplied with freſh ſtreams of fixed air, grew above an inch within the ſpace of ſix days. Another ſprig, in half an ounce of ſimple rain-water, was in a much leſs healthy ſtate, and had ſcarcely acquired any perceptible increaſe in that time.

April 14. THIS experiment was repeated with a ſprig of BALM, which flouriſhed and grew faſt in the fixed air.

IT has been ſhewn, that a plant grows faſter in mephitic, than in ſimple unimpregnated water. The following experiments ſeem to evince, that the fixed air is abſorbed by the roots of the vegetable; and that it affords them real nouriſhment.

April 18th. A SPRIG of MINT, with a ſhort root, was put into a ſix ounce phial, full of rain-water, ſtrongly impregnated with fixed air. Another phial of the like ſize was filled with the ſame mephitic-water, and placed without a cork, contiguous to the former, upon a ſhelf in my ſtudy. At the end of four days they were carefully examined; the ſprig of mint was in a very flouriſhing ſtate, and the water in which it grew had loſt its acidulous taſte; yet it produced a precipitation when mixed with lime-water. But the ſtandard of mephitic-water ſtill retained a conſiderable degree of pungency; and when poured into lime-water, rendered it quite milky.

An auricula, fully blown, and juſt gathered from my garden at Hart-Hill, was ſuſpended by a ſtring in the veſſel of fixed air, and frequently ſupplied with freſh ſtreams of it. The bloom of this delicate flower continued perfectly unimpaired during eight days; when it was withdrawn, as the proſecution of the experiment interfered with another which I had in view. The auricula when taken out of the fixed air, withered in a few hours.

May 2d. A LILAC, before the flower was blown, was put into the veſſel of fixed air, and occaſionally but not frequently ſupplied with freſh ſtreams of it. It weighed, at the commencement of this experiment, two ſcruples thirteen grains and an half; and when taken out, at the expiration of ſeven days, only thirty-three grains; having loſt one ſcruple and half a grain of its weight. The flower was a little withered, as much, I conjectured, as it would have been by lying in the open air about ſix hours. The ſtalk was dry. This flower was without any green leaves; and it is not improbable that the abſorbent veſſels are confined to theſe leaves *(d)*.

A TULIP, about half blown, was put into the veſſel with the lilac. It ſeemed not to flouriſh, but opened ſo much in the veſſel that, at the end of ſeven days, I found a difficulty in taking it out

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(d) SEE Grew's Anatomy of Plants. Hales's Statical Eſſays. Hunter's Georgical Eſſays.

of the aperture, through which at firſt it had paſſed very readily. The tulip had no leaves: its colour remained unchanged.

May 10th. A BRANCH of LILAC, which weighed eighty-ſix grains and an half, was put into the veſſel. Some of the flowers were blown; but moſt of them remained in a cloſed ſtate. I plucked off four green leaves before the branch was expoſed to the fixed air, to ſee whether it would grow and flouriſh by the abſorption of the flowers and ſtalk alone. It ſhould be remarked that the ſtalk of the lilac is woody and not very ſucculent.

May 18th. THE air had not been renewed during forty-eight hours, owing to my abſence from Mancheſter. Several of the flower cups of the lilac were more open than at firſt; but the flowers were ſomewhat withered, probably as much as they would have been by lying eight or ten hours in the open air. The whole branch had loſt eighteen grains of its weight.

A PURPLE FLOWER, unblown, was ſuſpended in the veſſel with the lilac. It weighed two ſcruples and ten grains; and was without leaves. The ſtalk was ſucculent.

May 18th. THE air had not been renewed during forty-eight hours, yet the flower was perfectly freſh, and its purple colour remained unchanged. Several of the flower cups were opened, and the ſeeds diſplayed. It had loſt ſix grains of its weight.

HAVING thus opened a path into a new and fertile region of ſcience, I ſhall diſcontinue my reſearches for a while; with a reſolution however to reſume them in the ſpring of the ſucceeding year. In the mean time I ſhall think myſelf happy if I can prevail upon my philoſophical friends to engage in the ſame purſuit, by offering them, as a clue, theſe few experiments; together with the following obſervations and conjectures, which have occured to my mind, during the proſecution of them.

SPECULATIONS.

1. The Floriſt, who is anxious to obtain a prize at ſome of the great meetings held for the encouragement of Horticulture, may perhaps avail himſelf of the powers of fixed air; and either quicken the growth of his favourite flower, if yet immature, or preſerve it in all its beauty till the expected day of deciſion. But it will be neceſſary to inform him, that the mephitic air ſhould be frequently renewed, or it will be corrupted by the perſpiration of the vegetable. For plants, like animals, form an atmoſphere around them, which proves unfavourable to their

health if not removed. An auricula was ſuffered to remain in the ſame fixed air many days. Its colours ſeemed not much changed; but a mouldineſs was viſible in the flower cups; the leaves were ſoft and flaccid; and the fine bloom of the flower was loſt. Theſe effects I aſcribed to the cauſe above mentioned. But my gardener has ſince ſuggeſted a doubt to me, by informing me that auriculas grow mouldy when the ſeed is completed. And it is poſſible that in this experiment the flower had finiſhed its proper office, and was gone into a natural not premature decay.

2. PERHAPS valuable ſeeds, collected in diſtant climates, may be preſerved by fixed air; and tranſported to other regions in the moſt perfect ſtate of vegetation?

3. Is there any analogy between the torpid ſtate of animals, during winter,

and the preſervation of flowers, ſtripped of their leaves, by means of fixed air? The vital principle ſeems to be preſerved in both; and the juices of each are ſlowly conſumed in the ſupport of it.

4. The *gas* of fermenting liquors appears to differ in ſome reſpects from pure fixed air. It affects the head and ſtomach more powerfully; changes the colours of flowers, and is preſently fatal to ſprigs of mint which are expoſed to it.

5. A plant in diſtilled water, Dr. Woodward obſerves, will not grow ſo faſt as in water that is not diſtilled. And if the water be diſtilled three or four times, the plant will ſcarcely vegetate at all. Diſtilled water is deprived of its fixed air; which is probably one of the conſtituent parts of this element, eſſential to the nouriſhment of plants.

6. LAND well drained, cultivated, and manured, is conſtantly in a ſtate of inteſtine fermentation *(e)*. The exhalations which ariſe from it may, perhaps, in part, conſiſt of fixed air; and this principle may be found to prove a very powerful agent in the proceſs of vegetation.

(e) CULTURE has a remarkable effect on climate. Draining land leſſens evaporation, and conſequently diminiſhes moiſture and cold. *Cold* and *barren* are terms always aſſociated together, when applied to ſoils. The felling of trees, clearing away underwood, and cropping of hedges, occaſions a more free circulation of air, and a drier climate. The perſpiration of trees, and exhalations from wet land, render the air colder; and cold air is leſs capable of diſſolving moiſture: when warmer air, therefore, which is ſaturated with aqueous vapours, paſſes over any colder region, the water will be precipitated in drops of rain. Hence uncultivated countries, *cæteris paribus*, are moſt rainy.

THESE remarks are not entirely foreign to the ſubject of this eſſay. And I have introduced them here to exhibit the importanee of agriculture, in a point of view, in which it is ſeldom beheld, either by the ſpeculative or practical farmer; who are little aware that they have an intereſt in every improvement made by their neighbours.

tion. Froſt meliorates ſoil chiefly by retaining theſe exhalations, the loſs of which impoveriſh and exhauſt it. Snow alſo, when it lies long on the ground, prevents the diſſipation of them, and thus affords time and opportunity for their abſorption by the roots and leaves of plants.

7. Doctor Priestley has diſcovered, that vegetables thrive admirably in putrid air, and alſo in that which has been corrupted by the breath of animals, and by the burning of candles; and that they reſtore ſuch air from a highly noxious, to a ſalutary and reſpirable ſtate. This effect he ſuppoſes to be produced by their inhaling thoſe *effluvia*, which are ſo fatal to animal life, and not by any addition to the atmoſphere, which ſurrounds them. From the foregoing experiments, we have reaſon to preſume, that this wonderful, and moſt uſeful power of plants, is extended to another

ſpecies of noxious air; and it will be the firſt object of my future trials to aſcertain this curious and important truth. Such diſcoveries heighten our admiration of the wiſdom and goodneſs of the Deity, by affording us freſh proofs that nothing is created in vain. "From the oak of the foreſt, to the graſs of the field, every individual plant is ſerviceable to mankind; if not always diſtinguiſhed by ſome private virtue, yet making a part of the whole which cleanſes and purifies our atmoſphere. In this the fragrant roſe and deadly night-ſhade co-operate: nor is the herbage, nor the woods that flouriſh in the moſt remote and unpeopled regions unprofitable to us, nor we to them; conſidering how conſtantly the winds convey to them our vitiated air, for our relief, and for their nouriſhment." *(f)*.

(f) See a diſcourſe on different kinds of air, delivered at the anniverſary meeting of the Royal Society, November 30th, 1773, by Sir John Pringle, Baronet, P. R. S.

8. As fixed air is ſo favourable to the growth of vegetables, perhaps it may equally contribute to the nouriſhment and ſupport of animals. It is ſeparated from our food, during the proceſs of digeſtion; and it may only be injurious to us when too copious; as exceſs in the quantity of water proves hurtful to the roots of plants.

N. B. It may be proper to inform the reader, who would chooſe to repeat my experiments, that they were generally made with the apparatus for impregnating water with fixed air, invented by Dr. Nooth, and ſold by Mr. Parker, glaſs-man, in Fleet-ſtreet, London.

May 20th, 1775.

MISCELLANEOUS

OBSERVATIONS

CONCERNING THE

ACTION

OF DIFFERENT

MANURES.

1. I APPREHEND, that oily ſubſtances cannot produce any conſiderable effect on land, unleſs they be previouſly combined with mucilages, or converted into ſoap by means of quicklime or fixed alkalis. In this ſtate they meliorate the ſoil in ſeveral ways, viz. by affording a laſting *pabulum* for plants; by fitting it to receive, and preventing the too ſpeedy evaporation of the dews and rains; and by preſenting the food of

vegetables in a due proportion to the abſorbent veſſels of their roots.

2. Saline ſubſtances, as they are ſoluble in water, and capable of admiſſion into the vaſcular tubes of plants, act more immediately on the earth. Whether they afford any real nutriment to vegetables, or whether their operation depends upon a ſtimulating power, by which they quicken vegetation, I am at a loſs to determine. For that plants are endued with *irritability* is evident from various facts. The ſenſitive tribe of vegetables afford us ocular demonſtration of it; and electricity is well known to accelerate the growth of plants, by promoting the aſcent of their juices.

3. Common Salt is univerſally eſteemed an excellent manure; but I think it would be ſtill more powerful, if a proper quantity of Epſom ſalt were added to it. By this combination it

would more exactly reſemble ſea-water, which amazingly fertilizes the marſhes over which it flows. The graſs of ſuch marſhes is purgative to horſes and to cattle; which affords a preſumptive proof, that ſea-ſalt, mixed with the bittern, may be received into the veſſels of plants in a much larger proportion than when purified and refined. The combination here recommended, will act as a powerful ſeptic, when mixed with the corrupted vegetables, and other putrefying ſubſtances on the ſurface of the earth; and by this fermentation will improve the ſoil.

4. QUICKLIME is not claſſed by the modern chemiſts amongſt the ſalts, though it has ſome properties in common with them. It may act as a manure by combining with and dividing the particles of clay, and thus forming a ſpecies of marle; by uniting with the oily ſubſtances contained in the ſoil, and render-

ing them ſoluble in water; and by abſorbing the dews and rains, and preventing them from ſinking too ſpeedily into the earth, by which the food of plants is waſhed from their radical fibres.

5. Lime and the fixed alkalis are more powerful agents, than neutral ſalts, in preparing the food of vegetables, by their operation on the oils and mucilages which exiſt in the ſoil, and which have been ſupplied by manures, or derived from the atmoſphere.

August 20th, 1770.

REMARKS

ON DIFFERENT

ABSORBENTS.

LANGIUS and Homberg, two able chemiſts have attempted to aſcertain the comparative powers of various abſorbents. But the acids which they employed being of the mineral claſs, and totally different from thoſe which exiſt in the human body, no accurate concluſions can be drawn from their trials, concerning the medicinal action of ſuch abſorbents *(a)*. The following table exhibits the reſult of ſome experiments, which I made about two years ago (February 1774) on this ſubject.

(a) See Lewis's new Diſpenſatory, page 64.

TABLE.

TABLE.

Abſorbents.	Diſtilled Water.	Drops of White Wine Vinegar.
Ten grains of Earth of Alum,	half an ounce,	13.
Magneſia,		24.
Calcined Magneſia,		42.
Prepared Chalk,		14.
Compound Powder of Crabs Claws.		10.
Salt of Tartar,		90.
Volatile Sal Ammoniac,		110.
Ten drops of Lixivium Tartari,		50.
Spirits of Hartſhorn.		45.

THERE is ſuch a diverſity in the purity of the ſame ſpecies of abſorbents, as well as in the ſtrength of different vinegars, that I am ſenſible theſe experiments are vague and indeterminate; though they were made with much attention, and the drops of acid here ſet down, were the medium quantity of ſeveral trials. However, as the ſubject admits not, ſo neither does it require mathematical certainty. And, we may, with ſafety and advantage, in this, as we are obliged to do in many other inſtances, found both our reaſoning and practice on *data*, which approach near to truth.

The method which I purſued in making the experiments, from which the foregoing table is deduced, was to add ſix or eight drops of the acid to the abſorbent; then to pour half an ounce of diſtilled water upon it; and afterwards to inſtil *guttatim*, as much vinegar as barely to occaſion a perceptible prevalence of the acid. In ſuch combinations the continuance of the efferveſcence is no teſt that ſaturation has not taken place. Three hundred drops of white wine vinegar were added, in the way above deſcribed, to ten grains of volatile ſal ammoniac. Every additional drop ſtill produced air bubbles; by which appearance I was ſo much deceived, that I ſhould have continued to add more vinegar, had I not found, by taſting the mixture, that it was extremely ſour.

And when I put into it a few grains of the volatile ſalt, a very briſk efferveſcence enſued. From this trial it ſhould ſeem, that the particles of the alkali combine with the acid more ſlowly and gradually than is commonly ſuppoſed; and this obſervation will be found to merit the attention of apothecaries.

The combination of vinegar, or juice of lemons, with *lixivium tartari*, yielded very little fixed air in my experiments. This mixture, therefore, is not well adapted to be given in the act of efferveſcence.

The mixtures of vinegar and earth of alum, alſo, emitted very few air bubbles. But the ſame acid with chalk, or compound powder of crab's claws, ſwelled much, and efferveſced violently.

The earth of alum, which I employed in theſe experiments, was prepared in the following manner. Two pounds of roch alum, freed, by waſhing, from all external impurities, were diſſolved in about five gallons of ſoft water. To this liquor, whilſt hot, four pounds and a half of a filtered ſolution of pot-aſhes were gradually added. The precipitated earth was repeatedly waſhed in hot and cold water, till it was entirely diveſted of ſaltneſs; and afterwards placed upon chalk ſtones, to be thoroughly dried. The alum, reduced to this ſtate, weighed only four ounces, ſix drachms, and twelve grains.

At the time when I was engaged in theſe inquiries, I received from a gentleman, juſt returned from Jamaica, a quantity of the eſſential ſalt of lemons, which he had made himſelf, by evaporating, in the ſun, the juice of that fruit, till it aſſumed a cryſtallized form. This acid was very grateful to the palate; and I diſſolved ſuch a quantity of it in diſtilled

led water, as to produce a liquor nearly reſembling freſh lemon juice. One ſcruple of it, as exactly as I could judge, ſeemed to be equal to a lemon of a common ſize.

An ounce phial, filled to the brim with the acid liquor thus made, weighed two ounces, five drachms, and half a grain. But an equal quantity of a ſaturated ſolution of the earth of alum in the ſame liquor, after being carefully filtered, weighed eight grains heavier; and a like ſolution of pure magneſia *(b)* twelve grains and an half. From hence it appears, that magneſia is much more ſoluble, in the vegetable acid, than the earth of alum. But the liquor is extremely nauſeous to the taſte; whereas the ſolution of the earth of alum is not unpleaſant, having a ſlight degree of ſweetneſs and ſtypticity.

(b) The magneſia I had from Mr. Henry, who is well known to prepare it with great ſkill and attention.

As the ſenſible qualities of alum, and of its earth, in combination with the vegetable acid, ſo nearly reſemble each other, we may preſume, that they are ſimilar in their medicinal powers. And I have employed this abſorbent with conſiderable advantage, in ſuch caſes of acidity as ariſe from an *atonia* of the ſtomach and inteſtines. But we ſometimes obſerve, that the ſame diſordered ſtate of the bowels, generates an acid in the ſtomach and *duodenum*, and a highly putrid acrimony in the lower inteſtines. A gentleman, after a moderate dinner of chicken, and a ſupper of apple tart and new milk, was affected, in the night-time, with great flatulency. His diſcharges of wind upwards were attended with the moſt corroſive acidity; thoſe downwards were uncommonly putrid and noiſome. His complaints terminated in a *diarrhœa*; and his evacuations were hot, ſharp, and intolerably fœtid. A lady had a rheumatic fever, about the middle of laſt ſummer, which, towards the concluſion, aſſumed a putrid type. Her ſtools were frequent and very offenſive; and ſhe had the moſt black and aphthous tongue I ever ſaw. Clyſters of fixed air were injected; acids, vegetable and mineral, were freely adminiſtered; and by theſe, and other means, the *diarrhœa* was reſtrained. A ſudden change took place in the ſtate of her bowels; and an acid acrimony ſeemed now to prevail as much as the putrid one had done before. In ſuch caſes as theſe, an intelligent phyſician will conſider, chalk, crab's eyes, and other ſeptic earths, as contraindicated; and will be glad to avail himſelf of ſuch an abſorbent as will, at the ſame time, corroborate and reſiſt putrefaction. The earth of alum might be deemed, *à priori*, to poſſeſs theſe powers in a very conſiderable degree; but from experiments I find, that, even when combined with the vegetable acid, it is a very weak antiſeptic.

tic. I ſaturated an ounce of lemon juice with it; another ounce with pure magneſia; and a third with *lixivium tartari*; and then added to each half an ounce of raw mutton, chopped very ſmall. The phials containing the mixtures were ſlightly corked, and placed in a heat of about 100 degrees of Fahrenheit's ſcale. A fourth phial, which was intended for a ſtandard, contained the ſame quantity of mutton, and an ounce of diſtilled water. In twenty-one hours, the mixture with the earth of alum was in briſk fermentation; the liquor was of a brown colour; much froth was collected on the ſurface, and it ſmelled offenſively, like faded cheeſe.

The mixture with magneſia did not ferment much; the liquor was of a bloody colour, and had a very offenſive and putrid ſmell.

The ſaline mixture was perfectly ſweet,

and had undergone only a ſlight fermentation.

The ſtandard was extremely putrid, and the liquor very bloody.

In forty-eight hours the aluminous mixture was more putrid and offenſive than that which contained the magneſia. The ſaline mixture continued perfectly ſweet.

I varied this experiment afterwards, by leaving the vegetable acid out of the mixtures; and uſing only the earth of alum, chalk, and magneſia. They all powerfully accelerated the corruption of the fleſh; the earth of alum proving the moſt, and magneſia the leaſt ſeptic.

A very ingenious Chemiſt has lately propoſed to the trial of the faculty a new ſaline preparation, namely, the vegetable alkali diſſolved in water, and perfectly ſaturated with fixed air, which he has demonſtrated to be an acid *(a)*. This compound he recommends as a febrifuge and antiſeptic in fevers, and other diſorders of a putrid tendency. I was ſo much pleaſed with the idea of this neutral julep, that I immediately prepared a ſmall quantity of it; by mixing ten drachms of the *lixivium tartari* with about a quart of pure water, and ſtrongly impregnating the ſolution with fixed air, by means of Dr. Nooth's apparatus. The nauſeous flavour of the alkali is almoſt entirely corrected by this proceſs, and the liquor has a grateful and acidulous taſte. The *lixivium tartari* ſeems to attract a very conſiderable quantity of fixed air *(b)*;

(a) SEE Mr. Bewley's excellent Letters, in the Appendix to Dr. Prieſtley's Second Volume of Obſervations on various kinds of Air.

(b) THIS will appear very evident by comparing together the efferveſcence produced in the neutralized and unneutralized *lixivium tartari*, when the vitriolic acid is added to equal quantities of each of them.

and as the mephitic acid has a weaker relation to it than any other, it will be ſeparated in the ſtomach; and this elegant ſaline julep will thus produce the good effects of a tonic and abſorbent. But when it is thought expedient to give this julep in a large quantity, not more than a drachm of *lixivium tartari*, ſhould be added to each pint of water. And even in this proportion, the alkali may prove too diuretic except in dropſical caſes, to which it ſeems to be well adapted. The pleaſanteſt beverage I have yet been able to prepare, is made by diſſolving a drachm and an half of the foſſil alkali, and twenty-five grains of bay ſalt, in three pints of pure water, which is then to be ſtrongly impregnated with fixed air. This liquor exactly reſembles very good Seltzer water; and may be drunk to ſatiety in hot climates; in hectic, imflammatory, or putrid diſorders, without danger, and with great advantage.

MISCELLANEOUS
OBSERVATIONS,
CASES,
AND
INQUIRIES.

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FIXED AIR.

FROM the obſervations advanced in a preceding eſſay on the ſolution of urinary *calculi*, it appears highly *probable*, that fixed air may be conveyed, by the ordinary courſe of circulation, to the kidneys and bladder. But I can now ſpeak *deciſively* concerning this intereſting point. For a young gentleman (Mr. Thomas Smith) has, at my deſire, taken

large

large quantities of mephitic water daily, during the ſpace of a fortnight. And whilſt he continued this courſe, his urine was ſtrongly impregnated with fixed air, as appeared from the precipitation which it produced in lime-water; from the bubbles which it copiouſly emitted when placed under the receiver of an air pump; and from the ſolution of ſeveral urinary ſtones, which were immerſed in it.

Dr. Priestley's favourable opinion of this new lithontriptic medicine may be collected from the following paragraphs, which I have extracted from the ſecond volume of his Experiments and Obſervations on air, page 216.

" It might be queſtioned, whether
" the fixed air contained in our aliments
" can be conveyed by the courſe of cir-
" culation into the blood, and by that
" means impregnate the urine. I have
" found, however, that it may do it;
" having

" having more than once expelled, from " a quantity of freſh made urine, by " means of heat, about one fifth of its " bulk of pure fixed air, as appeared by " its precipitating lime in lime-water, " and being almoſt wholly abſorbed by " water; and yet a very good air pump " did not diſcover that it contained any " air at all.

" It muſt be obſerved, however, that " it required ſeveral hours to expel this " air by heat; and, after the proceſs, " there was a conſiderable whitiſh ſediment " at the bottom of the veſſel. " This was probably ſome calcareous " matter, with which the fixed air had " been united; and by this fixed air, " the calcareous matter, which would " otherwiſe have formed a ſtone or gravel, " may have been held in ſolution. " And, therefore, drinking water, impregnated " with fixed air, may, by impregnating " the urine, enable it to

" diſſolve calcareous matters better than
" it would otherwiſe have done; and
" may, therefore, be a means of pre-
" venting or diſſolving the ſtone in the
" bladder, agreeable to the propoſal of
" my friend Dr. Percival."

Sir John Pringle informs me, that he has known great benefit to accrue from the uſe of honey in caſes of the gravel, or when the kidneys are loaded with ſand. He directs about a pound and a quarter of this remedy to be taken every week, and continued for a conſiderable ſpace of time. And as it perfectly coincides with the artificial mineral water, being diuretic and containing much fixed air, he recommends to me the trial of them together. My readers will, I doubt not, be much pleaſed with this valuable hint.

MAY not mephitic water prove an active and uſeful remedy in ſuch ſpecies of dropſies as originate from obſtructions in the liver, or from a general *atonia* of the ſolids, and poverty of the fluids? From its ſtimulant and penetrating powers, it ſhould ſeem well adapted to pervade the minuteſt ſeries of veſſels; as a ſtrengthener, it will give vigour to the organs of digeſtion; and as a diuretic, will tend to carry off, by urine, the ſuperabundant ſeroſities. In the *anaſarca* and *aſcites* the blood is generally of a looſe texture, and the coagulable lymph is ſometimes ſo much diſſolved, that the whole maſs aſſumes the appearance of gelly. As fixed air has been ſhewn, by Dr. Hales and Dr. Macbride, to be a bond of union to the particles of matter, may not mephitic water contribute to ſupply the animal fluids with this cementing principle? Other tonic and diuretic remedies may be combined with this grateful liquor; and if the patient's thirſt be immoderate, and his caſe attended with imminent danger, he may be allowed to drink of it to ſatiety *(a)*. The waters of Bath, in Somerſetſhire,

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(a) Sanatur, indulgens ſibi, dirus hydrops.

The following paſſage is extracted from a letter which I have lately received from my learned friend Dr. Baker.

"Have you heard of a M. Bacher? Such is ſaid to have been his ſucceſs in dropſies, that the French government has been induced, from the report made of the effects of his *tonic pills*, to purchaſe the ſecret of their compoſition; trials being firſt made under the eye of the court phyſicians. The chief ingredient in the pills is the black hellebore; but Bacher ſays, that without the aſſiſtance of *diluents* he could do nothing. "*Le malade buvoit a ſa ſoif*," is the language of every page. This puts me in mind of ſome caſes, which I publiſhed, in the ſecond volume of the Medical Tranſactions; and I have lately been informed from Vienna, that Dr. Colin has more ſucceſs than others with the ſame medicines, probably becauſe his patients are allowed to drink *ad libitum*."

have been found to be ſignally ſerviceable in œdematous ſwellings of the legs, which have ſucceeded intermittents; and alſo in anaſarcas, when the ſtrength has not been too far impaired *(b)*. I have repeatedly experienced the ſalutary effects of Buxton water in ſimilar caſes: and as theſe celebrated ſprings owe their virtues in part to the fixed air which they contain, their efficacy in dropſies affords ſufficient encouragement to the trial of mephitic water in the ſame diſorders.

FIXED AIR, conveyed by a proper tube into the noſtrils, ſeems likely to prove the beſt topical application in the OZÆNA; whether the diſeaſe be ſeated in the *antrum Highmorianum*, or in the frontal ſinuſes. It will be eaſy to guard the patient againſt drawing into his lungs too

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(b) See Falconer on the Bath Waters.

large a quantity of this air, by directing him to breathe with his mouth open during the operation.

EXTRACT OF A LETTER FROM DR. ROTHERAM OF NEWCASTLE UPON TYNE.

I HAVE been very attentive to what you and Dr. Prieſtley have ſo well ſaid upon fixed and factitious air; and hope it will be found a moſt valuable acquiſition to our art. Yet let me crave your pardon and patience for a moment, whilſt I lay down my reaſons for applying it in a manner, which you ſeem but ſlightly to inſiſt upon, but by which, I flatter myſelf, I have done ſubſtantial ſervice.

THE lungs are, undoubtedly, the principal organ, by which a conſtant and neceſſary communication between the freſh air and the blood is carried on: that every inſpiration conveys, into the blood, ſome particles from the air, which are neceſſary to life: and that every expiration carries off particles which are noxious, or, if I may be allowed the expreſſion, excrementitious; ſo that the ſame air cannot, without injury, be breathed twice over. This part of the animal œconomy is ſo well known, that I need not expatiate, with you at leaſt, any farther upon it; nor upon the obvious concluſions which flow from it. But from hence, I think we may fairly argue, that in putrid fevers, or in ſimple inflammatory fevers, where we often find a general tendency of the animal fluids to putrefaction; and when certain kinds of factitious air are known to impede, reſiſt or overcome this putreſcency; the moſt effectual way of applying it ſhould be to throw it liberally into the lungs, that it may be diſtributed through the whole courſe of the circulation, and given not merely as a topical but general medicine to comprehend every intention which can be anſwered by it.

We have had a very diſagreeable fever, often attended with putrid ſymptoms, raging in this town all the laſt winter; but at preſent, thank God, it is greatly abated. As I make it matter of principle to attend as many of the poor as I am able; I have ſeen great numbers. They have commonly begun with the uſual ſymptoms of ſhivering, drowſineſs, erratic pains, &c. ſometimes with a *diarrhœa* and *teneſmus*; the pulſe always quick, but ſeldom ſo full or hard as to indicate bleeding with propriety; and where it has been done, I generally thought miſchief attended it, by ſinking the pulſe, and bringing on ſymptomatic or colliquative ſweats, which I always found very difficult to manage. The putrid ſymptoms commonly appeared upon the ſinking of the pulſe; in a great many, ulcerations of the throat with *aphthæ*; black, fœtid, and ſometimes bloody ſtools; in ſome caſes, large and numerous veſications; and in one or two, livid *petechiæ*. The mouth, tongue, lips, and teeth covered with a dry, foul, black cruſt; the cadaverous ſmell, incontinence of ſtool and urine, *ſubſultus tendinum*, cold ſweats, and death. I cannot avoid attributing ſome of theſe miſchiefs to the conſtant uſe of an alkaline water, which, notwithſtanding the remonſtrances I formerly made againſt it, was brought into this town, and has for ſome time been in common uſe for brewing, &c. but you will ſee my objections to it in the 31ſt page of my Inquiry, under the article of Cox-lodge water.

After ſome unſucceſsful caſes, I generally found the following method to anſwer beſt. In whatever ſtage I was called, I ſcarcely deliberated in ordering a vomit or two, as I found the patient could bear it; occaſionally gave carminative glyſters, with ſtrong decoctions of chamomile, &c. and ſaline draughts, with rather a predominant ſhare of acid, taken in the time of effervеſcence every ſix hours. At firſt I gave twenty-five or thirty drops of *vin. antimonial.* in each ſaline draught; but I afterwards thought proper to lay it aſide. I moſtly found bliſters to do evident harm, I therefore totally refrained from them; and when I found the pulſe ſinking, and the putrid ſymptoms appearing, gave moderate quantities of port wine, and in ſome caſes plentiful draughts of bottled cyder. But I certainly found the greateſt benefit from the liberal uſe of factitious air, which I applied in the following manner, viz. I took a narrow-necked jug, which held at leaſt two quarts, and filled about half with chalk and water, mixed to about half the conſiſtence of common whitewaſh; and raiſing the patient in bed, or ſetting him in a chair, if able, placed the jug under his head, and dropped in about half an ounce of oil of vitriol at a time, ſtirring and continuing it gradually for a quarter of an hour, or until it occaſioned a little gentle irritation and cough; and this I repeated ten or twelve times in the day. If the patient was too weak to be raiſed, I mixed and ſtirred it in a larger open veſſel, by the bed-ſide, till the agreeable ſmell of the effluvia was ſenſibly felt through the whole room; and I look upon this as a good prophylactic to the nurſes and attendants.

When I have been called in the firſt ſtage of the fever, I think, I have not once failed, by perſevering in this method, of keeping off every putrid appearance through the whole courſe; and though, as you juſtly obſerve, it alters not the uſual time of the criſis; nor has it always prevented the fatal termination of fevers; yet the guarding againſt theſe dreadful putrid appearances is a very material point gained. But I have ſtill ſomething ſtronger to add; in ſome very recent caſes, where I have not been called till the eleventh or twelfth day, after the patient had been above eight days delirious; with the black foul cruſt, fœtid breath, total inſenſibility of ſtool, or urine, livid countenance, and almoſt every dreadful putrid appearance; by ſix hours unremitted application of theſe fumes, and ſometimes waſhing the mouth with port wine, large ſloughs have been caſt off, frequently mixed with blood; the mouth and fauces rendered freſh as a roſe, the breath perfectly ſweet; and, in ſhort, the putreſcency totally vanquiſhed. I aſſure you, dear Sir, I do not magnify, but am happy in having ſeveral full and living proofs to produce.

In theſe deſperate caſes, I make the effervefcence as ſtrong as the people in the room can agreeably or conveniently bear it, uſing frequently two or three pounds of the oil of vitriol in the day, which we buy here for ſeven-pence per pound; and, therefore, I never ſpare it to the pooreſt patients, whoſe ſordid diet and habitations more eſpecially require it."

J. Rotheram.

PREPARATIONS OF LEAD.

THOUGH I entertain a very high opinion of the uſefulneſs of Saturnine preparations, externally applied, and frequently preſcribe them; yet I am fully convinced that they *ſometimes* produce the ſpecific effects of lead upon the body. And I could wiſh that more attention were paid to the operation of ſuch topical remedies, eſpecially when applied to conſtitutions to which we are ſtrangers.

There are indeed ſome habits which appear very little diſpoſed to be affected by this mineral poiſon, of which I have given ſeveral examples in my *Obſervations and Experiments on Lead,* and can now add two others. The firſt was communicated to me by Mr Barker, ſurgeon in Bakewell; the ſecond, by the late Dr. Small, an excellent philoſopher, and a phyſician of great eminence at Birmingham.

Two ſmelters, who have worked *nineteen years* at the ſmelting mills, have conſtantly, during that time, toaſted the cheeſe, and broiled the bacon, and other proviſions which they uſed, on the hot pigs of lead, without the leaſt apparent inconvenience. They are ſtout, healthy men, and have never experienced any pains in their bowels. And, as this method of dreſſing meat renders it remarkably ſweet and palatable, Mr.

Barker could not prevail upon them to diſcontinue it.

A GENTLEMAN, who had been long troubled with the heart-burn, diſcovered, from repeated trials, that his malady was relieved by ſwallowing a large quantity of ſaliva. To increaſe this ſecretion, he chewed, many hours every day, a piece of lead, which being neither hard, friable, nor offenſive to the palate, ſuited his purpoſe better than any other ſubſtance. This practice he continued many years, with great advantage, and without injury, in any reſpect, to his health.

BUT the ſame learned phyſician informed me, that he had ſeen three inſtances of the fatal effects of Goulard's Extract of Lead externally applied. Two of the caſes were incipient white ſwellings; the third was a tumour of a more uncommon kind. Each of the patients became paralytic, and two of them were convulſed ſeveral days before death. I lament that Dr. Small did not favour me, in his letter, with a more circumſtantial relation of theſe caſes; but his judgment and accuracy may be relied upon with confidence.

From the preſent univerſal uſe of the Saturnine Water of Goulard, it may be thought ſurpriſing that ſuch melancholy examples as theſe do not more frequently occur. But this preparation happily contains ſo ſmall a portion of lead, that it is capable, in the moſt irritable habits only, of producing its peculiar effects. An ounce phial, filled to the brim with the *Extractum Saturni*, weighed ſixty-five grains and an half heavier than the ſame quantity of the vinegar with which it was prepared. A hundred drops of this Extract, the quantity uſually mixed with a quart of rain-water, are about the fifth part of an ounce, and may be ſuppoſed to ſuſpend thirteen grains of lead, if no change be produced, by combination, in the ſpecific gravity of the compound. Each ounce, therefore, of the vegeto-mineral water contains only four tenths of a grain of this metal.

THE *Aqua Saturnina*, employed in the following caſe, was ſtrongly impregnated with lead, having an ounce of the Extract in every quart of water. On Thurſday February 16, 1775, Mr. P——, a young man of a delicate habit of body, had a tea-kettle full of boiling water thrown upon his leg, by which the cuticle was ſeparated from the knee to the toes. Oily applications were immediately uſed; but the pain and inflammation were ſo great the following day, as to require the aſſiſtance of the ingenious ſurgeon to whom I am indebted for this account. A gentle laxative was directed; the patient's leg and foot were well waſhed every three hours with Goulard's Saturnine Water, and afterwards covered with linen ſoaked in the ſame lotion, and wetted with it from time to time. The relief obtained by theſe means encouraged the young man's friends to uſe the lotion in an immoderate quantity; for, in ſix days, no leſs than 7 quarts of water were conſumed. On Wedneſday night, the ſixth from the firſt application of this remedy, the ſurgeon was called to his patient, and found him violently afflicted with the colic, trembling of his limbs, continual nauſea, and frequent vomitings. He had been coſtive three days, and had neglected to take a purgative medicine preſcribed for him. It may be proper to point out the progreſs of theſe ſymptoms, as they ſeem to mark the gradual operation of the lead. On Monday the conſtipation commenced, and a ſlight tremor was perceived in the ſcalded limb: the tremor continued on Tueſday: on

Wedneſday the colic ſupervened, which grew extremely ſevere and alarming in the evening, and was aggravated by the ſickneſs and reachings which accompanied it. Directions were given to diſcontinue the lotion; the *Ceratum Sambucinum*, ſpread upon linen, was applied to the parts affected, and the following draught was adminiſtred every four hours.

℞. *Ol. Ricini V. O. Subact.* ℥ſs.
Aq. Menth. Pip. Simp. ℥ i.
Tinct. Thebaicae gutt. vii.
Syr. e Meconio ʒ i. *M. F. hauſtus.*

Several motions were procured by the repetition of this draught; the complaints of the patient became more moderate; and the colic entirely ceaſed before the next evening. But a ſoreneſs of the *abdomen* remained, and the body was left in a very irritable ſtate. The ſcalded leg and foot, in eight days, were more healed, than is uſual after ſuch accidents, in three weeks, when unctuous remedies are employed.

I HAVE ſeen and examined the patient, whoſe caſe is here related, and can atteſt the faithfulneſs and accuracy of this account.

THE facts which I have now adduced, in conjunction with thoſe contained in my treatiſe on the poiſon of lead, afforded a ſtrong preſumption, that Saturnine preparations, externally applied, are not ſo perfectly innocent as they are too generally aſſerted and believed to be. One poſitive proof, well authenticated, outweighs a thouſand negative ones; eſpecially when ſuch poſitive evidence is acknowledged but rarely to occur. And I ſhall be happy in the idea of having done ſome ſervice to the community, if I can excite more attention to the operation, and more caution in the uſe of theſe topical remedies, which are deſervedly eſteemed, and univerſally employed. My deſign is not to diſparage them, but only to recommend a juſt diſcrimination of their effects. Whenever tremors of the limbs, paralytic affections, coſtiveneſs, yellowneſs of the countenance, or pains in the bowels, ſucceed the application of any Saturnine compoſition, the uſe of it ſhould be for a while ſuſpended, or entirely diſcontinued; and the proper antidotes to the poiſon of lead ſhould be ſeduloufly adminiſtred. Thus will the danger be obviated on its firſt approach; and we ſhall not be reduced to the ſorrow and diſgrace of having cured an ulcer, a burn, or a contuſion, by inflicting the moſt excruciating tortures, or perhaps at the expence of life.

It has been obſerved in the Medical Eſſays, publiſhed by a Society in Edinburgh; "that though opium produces "ſuch certain effects in the ſtomach,

" yet it is not clear, that it has any operation externally, even when applied " to the bare nerves in a part excoriated " by a bliſter." This has been urged as an argument againſt the topically poiſonous action of lead. But the obſervation is not founded in truth, and is contradicted by facts which daily occur in medical practice. For what phyſician is a ſtranger to the powers of opium when applied to the nerve of an aching tooth, or to the eyes in an *ophthalmia*?

DR. HEBERDEN remarks, in his very ingenious lectures on poiſons, that lead affords a ſingular inſtance of a poiſon which only affects the nerves of motion: " tremblings, ſtrong ſpaſms, and palſies, are its uſual conſequences; but I apprehend it has been ſeldom or never found to injure the underſtanding, or to make the patient delirious, till he becomes ſo, as is common in moſt diſtempers, by the near approach of death." I believe this obſervation,

tion, with reſpect to the human ſpecies, is as juſt as it is curious; but cats become frantic by ſwallowing lead.

I HAVE obſerved, that peſtles and mortars, for the uſe of apothecaries and others, are made of the Burſlem pottery. This muſt be attended with pernicious conſequences; becauſe the lead in the glazing will be diſſolved by the acids, which are frequently employed in medicine; and the particles of it will be abraded by conſtant friction. Perhaps theſe particles may alſo be of ſuch a ſize and ſharpneſs, as to injure, by their mechanical action, the coats of the ſtomach; for the glazing is very unequally diffuſed over the ſurface of the coarſer ware.

SMALL POX.

DR. HAYGARTH, to whom I communicated my *Tables of the comparative Mortality*

Mortality of the Small Pox, &c. has adopted the plan, and purſued the ſame inquiry at Cheſter. The following tables will ſhew how exactly our obſervations coincide.

CHESTER, 1774.

Total of deaths by the ſmall pox, - - - 202.
Deaths by the ſmall pox under one year old, 51.

viz.

	Males.	Females.
Under 1 month,	0.	0.
Between 1 and 2 months,	1.	1.
2 and 3,	1.	0.
3 and 6,	2.	2.
6 and 9,	12.	10.
9 and 12,	6.	16.
Total	22.	29.

In the ſecondary fever of the ſmall pox a *warm bath*, prepared of a decoction of chamomile leaves and flowers, with a proper quantity of butter-milk added to it, produces the happieſt effects. It cleanſes the ſkin from the putrid *ſordes* which covers it; ſoftens the puſtules; opens the pores; promotes perſpiration; and proves highly refreſhing to the patient.

POISON OF COPPER.

JOHN BERRY, aged three years, on Saturday, July 9th, 1774, ſwallowed an halfpenny. The ſucceeding day he had ſevere vomitings, and could retain nothing upon his ſtomach. As deglutition was performed with the utmoſt facility, and as the child was ſenſible of no uneaſy irritation in the *œſophagus*, I concluded that the vomitings were owing to a ſolution of the copper in his ſtomach. A purgative was given him juſt before he went to ſleep, but the greateſt part of it was quickly rejected. The next morning he vomited a large quantity of a green coloured fluid, which had the ſmell of verdigriſe. After this diſcharge the vomiting ceaſed; and his appetite being very voracious, he eat heartily of ſolid food. He uſed a good deal of violent exerciſe during the courſe of the day; and in the evening a clyſter was injected. With the ſtool which followed it, the halfpenny was diſcharged, covered with verdigriſe. The green mould of cheeſe may ſometimes be produced by verdigriſe. A lady, who is very fond of faded cheeſe, lately eat ſome which ſhe thought had a peculiar and diſagreeable taſte. On cutting farther into the mouldy part, a pin was diſcovered in the centre of it. The ſalt contained in the cheeſe probably produced the verdigriſe, by the ſolution of the ſurface of the pin *(c)*.

(c) I cannot omit this opportunity of recommending to the reader, an attentive peruſal of Dr. Falconer's very ingenious and uſeful Obſervations and Experiments on the Poiſon of Copper.

FATAL EFFECTS OF YEW LEAVES.

ON Friday, March 25th, 1774, three children of James Buckley, a labouring man at Longſight, near Mancheſter, were killed by taking a ſmall quantity of the freſh leaves of the yew tree, or *taxus officinalis* of Caſpar Bauhin. The oldeſt child was five, the ſecond four, and the youngeſt three years of age. They were all ſuppoſed to be affected with the worms; and this poiſon was given them, by the recommendation of ſome ignorant perſon, as a powerful remedy for that diſorder. The *dried leaves* were firſt employed; and a ſpoonful of them, mixed with brown ſugar, was divided into three equal doſes, which the children took at ſeven o'clock in the morning. At eight, they had each a meſs of pottage, prepared of butter-milk, which, having been kept ſeveral days, was become very ſour. No complaints were made by the children; nor did any bad effects enſue. Two days afterwards the mother collected *freſh leaves*, and adminiſtered them in the ſame doſe, as before, and at the ſame hour. At eight o'clock the children breakfaſted of nettle-pottage, that is, oatmeal gruel with freſh nettles boiled in it, a meſs well known in this country. At nine, they began to be uneaſy; were chilly and liſtleſs; yawned much; and frequently ſtretched out their limbs. The oldeſt vomited a little, and complained of gripings in his belly; but the others expreſſed no ſigns of pain. The ſecond child died at ten o'clock; the youngeſt about one; and the oldeſt at three in the afternoon. No agonies accompanied their diſſolution; no ſwelling of the *abdomen* enſued; and after death they had the appearance of being in a placid ſleep. Theſe particulars I learned from the unfortunate parents of the children; whoſe ignorance led them too long and too fatally to rely on the trifling and inefficacious means of relief, ſuggeſted to them by their neighbours *(d)*.

(d) BROOKES, in his Natural Hiſtory, aſſerts, that the yew is not a poiſonous tree, vol. VI. page 396.

CATIVULCUS, [redacted] deſtroyed himſelf by it, as appears from the following paſſage in Cæſar's Commentaries. *Cativulcus Rex dimidiæ partis Eburonum, qui unà cum Ambiorige conſilium inierat; ætate jam confectus, quum laborem aut belli aut fugæ ferre non poſſet; omnibus precibus deteſtatus Ambiorigem, qui ejus conſilii auctor fuiſſet,* TAXO, *cujus magna in Galliâ Germaniâque copia eſt, ſe exanimavit. Comment. lib.* 17. *Sect.* 29.

AN EXTRA UTERINE FŒTUS, VOIDED BY STOOL, TWENTY-TWO YEARS AFTER PREGNANCY.

MRS. —— of Row-Croſs, near Mottram, July 1751, when in the ſixth month of her pregnancy, and twenty-fourth year of her age, received a ſudden fright, which occaſioned a ſevere pain in her loins, and was ſoon ſucceeded by a flooding, but without a miſcarriage. Theſe ſymptoms were relieved by the medicines, then directed for her by an experienced and judicious ſurgeon. But the *abdomen* afterwards became much diſtended; and continued ſo about half a year, when it ſubſided all at once, whilſt ſhe was in a recumbent poſture. Her *menſes* in a ſhort time appeared, and returned at the ſtated periods, with ſufficient regularity; but they were always attended with violent pain. Milk alſo flowed from her breaſts during ſeveral years. In 1757, ſhe was afflicted with great flatulence, and often with hyſterical fits. Her uterine diſcharges were become very putrid, and her health and ſtrength ſeemed to be gradually impairing. She conſulted me in May 1772; and received great benefit from an emetic, an infuſion of the Peruvian bark, and from frequent doſes of the acid elixir of vitriol. My advice was again deſired in May 1773. At this time ſhe laboured under the hæmorrhoids; complained of great pain in her loins, and about the *os ſacrum*; had frequent fluſhings in her face, and was much troubled with ſickneſs and thirſt. The apothecary had taken eight ounces of blood from her arm, and had given her ſome aperient medicines. I directed leeches to the hæmorrhoidal veins; an electuary, compoſed of the lenitive electuary and flowers of ſulphur; an infuſion of columbo root; and the following clyſter, to be injected every night at bed-time.

℞. *Ol. è Pedib. Bov.* ℥ *iv. Tinct. Thebaic.*
V. O. ſubact. ʒ *i. M. F. Enema.*

May 12th. SHE began this courſe of medicine.

13th. SHE diſcharged by the *anus* two bones of a child's head.

14th. SHE voided, in the ſame way, another bone of the head.

17th. SHE diſcharged the trunk of the body, wanting ſome of the *viſcera*, of a female *fœtus*.

19th. SHE parted with a thigh bone.

The patient was not afterwards ſenſible of any farther diſcharges of this nature.

June 7th. I SAW her: her pains were then abated; her appetite was improved; and her ſtrength ſeemed to be daily increaſing. In this ſtate of convaleſcence, ſhe continued two months; and then, from ſome cauſe which the diſtance of her place of abode has yet prevented me from learning, ſhe ſuddenly relapſed, and died in a few days.

THE RARITY OF THE AIR A CAUSE OF HÆMORRHAGES.

IN the ſecond part of the ſixty fourth volume of Philoſophical Tranſactions, Dr. Darwen has favoured the public with ſeveral well conceived experiments, which afford a ſatisfactory proof, that air does not exiſt in the fluids of the human body in an elaſtic ſtate; or in ſuch a ſtate as to become elaſtic by any change, yet experienced, in the weight of the incumbent atmoſphere. Hence he concludes, that the accounts of hæmoptoes, and other diſcharges of blood, from perſons who have aſcended high mountains, are either not to be depended upon, or to be aſcribed to violent exerciſe, or to ſome other accidental cauſe.

The relation of ſuch hæmorrhages are too well authenticated, in my opinion, to admit of doubt or controverſy; and they may be explained upon rational and philoſophical principles. The preſſure of the external air muſt be allowed to be a cauſe of reſiſtance, to the propulſion of the blood, through the vaſcular ſyſtem. If this preſſure be diminiſhed, and the action of the heart remain the ſame, it is obvious that the fluids will be propelled with greater force, and that the ſmall veſſels will be more diſtended by them. This effect we ſee partially produced by the cupping glaſs; which occaſions a *plethora* in the veſſels over which it is applied, by diminiſhing the reſiſtance to the circulation of the blood through them. Upon the tops of high mountains the rarity of the air diminiſhes this reſiſtance univerſally; but thoſe veſſels of the body will be moſt diſtended by the *vis à tergo*, which belonging to the tendereſt organs, are leaſt capable of reſiſtance. Hence thoſe of the lungs, noſtrils, eyes, &c. are moſt liable to be ruptured.

HEAT is obſerved to diſtend the veſſels, and to enlarge the bulk of the human body. This effect it produces, not by rarifying the air contained in the blood, but by its expanſile power; and by its ſtimulus on the heart and arteries, All bodies are dilated by heat; and mercury.

cury, though freed from air, quicker than almoſt any other.

ELECTRICITY.

WHEN the gout leaves the extremities, and invades other parts of the body, ſinapiſms, bliſters, and volatile epithems, are often applied to the wriſts or to the feet, to recal the diſorder to its uſual and natural ſeat. The ſame remedies are alſo employed to ſolicit the gout to the extremities, when it has yet made only irregular attacks on the ſyſtem. Might not ſlight, or even ſevere ſhocks of electricity, be highly ſerviceable on ſuch occaſions? The ſtimulating applications, abovementioned, chiefly affect the ſkin; whereas the electrical ſtroke inſtantly pervades the tendons, articulations, and other internal parts, ſuppoſed to be the ſeat of this diſorder.

In palſies, proceeding from the receſſion of the gout, we ſhould be leſs liable to diſappointment in our expectations from electricity, when thus partially applied, than by the general ſhocks ſo indiſcriminately given.

A POISONOUS SPECIES of MUSHROOM.

AUGUST 1772. Robert Usherwood, of Middleton, near Mancheſter, a ſtrong healthy man, aged fifty years, early in the morning gathered and eat what he ſuppoſed to be a muſhroom. He felt no ſymptoms of indiſpoſition till five o'clock in the evening; when, being very thirſty, he drank near a quart of table-beer. Soon afterwards he became univerſally ſwoln; was ſick; and in great agonies. A ſevere vomiting and purging ſucceeded, with violent cramps in his legs and thighs. He diſcharged ſeveral pieces of the *fungus*; but with little or no relief. His pains and evacuations continued, almoſt without intermiſſion, till the next night; when he fell into a ſound ſleep, and awaked in the morning perfectly eaſy and free from complaint.

I have ſent to Mr. Hudſon, author of the *Flora Anglica*, a ſpecies of *fungus*, which the poor man thinks exactly reſembles what he ſwallowed. And it appears to this ingenious botaniſt to be the *Agaricus Clypeatus* Linn. Spec. Plant. pag. 1642; of which there is a good figure in Scheffer's *Icones Fungorum*.

COFFEE.

COFFEE.

OCTOBER 19th, 1774. A PHYSICIAN was affected with a ſevere headach, in conſequence of having been diſturbed in the night. At two o'clock in the afternoon he took eighteen drops of laudanum, and immediately afterwards, three diſhes of very ſtrong coffee. He lay down upon the bed, and endeavoured to compoſe himſelf to ſleep. His pain abated in half an hour; and in an hour was entirely removed: but he felt not the leaſt diſpoſition to ſleep, although he is often drowſy after dinner, and ſometimes indulges himſelf in ſleeping at that time.

November 1ſt. HE repeated, on a ſimilar occaſion, the uſe of laudanum and coffee, in the like quantity as before. The effects were preciſely the ſame; eaſe from pain, but no diſpoſition to ſleep.

November 16th. He took eighteen drops of laudanum, when under the head-ach, but without coffee. The opiate compoſed him to ſleep in an hour; but did not entirely remove the pain in his head. Theſe facts confirm a remark which I have made in a former volume, that coffee is taken in large quantities, with peculiar propriety, by the Turks and Arabians, becauſe it counteracts the narcotic effects of opium, to the uſe of which theſe nations are much addicted *(e)*.

The following curious and important obſervation is extracted from a letter with which I was honoured by Sir John Pringle, in April 1773. "On reading

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(e) Volume ſecond, page 128.

your ſection concerning coffee (*f*), one quality occurred to me which I had obſerved of that liquor, confirming what you have ſaid of its ſedative virtues. It is the beſt abater of the paroxyſms of the periodic aſthma, that I have ſeen. The coffee ought to be of the beſt Mocco, newly burnt, and made very ſtrong immediately after grinding it. I have commonly ordered an ounce for one diſh; which is to be repeated freſh after the interval of a quarter, or half an hour; and which I direct to be taken without milk or ſugar. The medicine in general is mentioned by Muſgrave, in his Treatiſe *de Arthritide anomala*; but I firſt heard of it from a phyſician of this place, who having once practiſed at Litchfield, had been informed by the old people of that place, that Sir John Floyer, during the latter year of his life kept free from, or at leaſt lived eaſy

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(*f*) Id. page 122.

under his aſthma, from the uſe of very ſtrong coffee. This diſcovery, it ſeems, he made after the publication of his book upon that diſeaſe." Since the receipt of this letter, I have frequently directed coffee in the aſthma with great ſucceſs.

WORMS DISCHARGED FROM THE LUNGS.

Mr. JOSEPH HANFORTH of Stockport, aged forty-nine years, had been long troubled with a cough, and with a fullneſs and oppreſſion at his breaſt. He frequently expectorated lumps of black, grumous blood; which gave him relief. In February 1774, the oppreſſion increaſed, and in the night he diſcharged, by coughing, two maſſes, one of the ſize of a nutmeg, the other ſmaller. They were of the colour of chocolate. When the larger ſubſtance was opened, it was found to contain a conſiderable number of worms, like maggots, in a very lively ſtate. His cough and expectoration ſtill continue; but the oppreſſion at his breaſt is not ſo troubleſome; and the diſcharge of coagulated blood is leſs frequent. This patient's complaints were not attended with any hectic ſymptoms; and he is unable to give any account of the origin of them. The late Doctor Watſon of Stockport ſaw, and examined the worms which he diſcharged. Schenkius, in his *Obſervationes Medicinales de Pulmonibus*, Lib. II. p. 249, relates a caſe ſomewhat ſimilar to that of Mr. Hanforth. The reader may alſo conſult Morgagni, Epiſt. XIX. Art. 41. Epiſt. XXI. Art. 43. *Lieutaud Hiſt. Anat. Med.* Vol. II. p. 40, Obſ. 572; p. 79, Obſ. 720.

MILIARY FEVER.

THAT the miliary eruption is *frequently* fabricated by cloſe rooms, heating remedies, and forced ſweats, is a truth acknowledged by almoſt every modern practitioner; and the danger and abſurdity of ſuch a method of treatment, in every ſpecies of fever, cannot be too ſtrongly enforced. But ſome very ingenious Phyſicians have ſuppoſed that the miliary fever, *invariably* and in *all inſtances*, is derived from the cauſes above recited; and they have flattered themſelves and the public, that by a cooling and antiſeptic regimen it may be baniſhed entirely from the catalogue of diſeaſes. This is an expectation which, I fear, experience will not warrant. Neither hot rooms, cardiac remedies, nor profuſe ſweating, produce at all times the miliary eruption; and I have ſeen it occur when the antiphlogiſtic regimen has been purſued to its full extent. Of this the following caſe, which I have ſelected from ſeveral others, affords a ſtriking proof.

February 4th, 1770. Mrs. L. aged 30, laboured under the uſual ſymptoms of a *febricula* or ſlow fever, for which ſhe took ſaline draughts, antimonials, and yeſterday a cathartic, which operated five times. She had four fainting fits previous to this evacuation; and ſoon afterwards a miliary eruption, of the white and red kind, made its appearance on her breaſt, arms, and the trunk of her body. Her pulſe, when I firſt ſaw her, beat 120 ſtrokes in a minute, and were extremely feeble; her heat was moderate; her tongue furred; her head painful; and ſhe laboured under a conſtant oppreſſion about the *præcordia*. Her houſe was in an elevated and airy ſituation; the weather was cold; ſhe lay in a large and well-ventilated chamber, at a diſtance from the fire; and with no more bed cloaths than ſhe uſed in health. The following medicine was directed.

℞. *Sp. Mindereri Seſcunciam; Elix. Paregoric. drachmas tres; Sp. Volat. Aromat. drachmam unam.*

M. Sumantur Cochl. ij. minima omni Seſquihora ex hauſtulo Seri Lactis Vinos. tenuis.

In a few hours I found her much relieved. She no longer complained of any oppreſſion at her breaſt; her ſkin was moiſt; and her pulſe fuller and ſlower. The miliary eruption was conſiderably increaſed; and her arms and hands were become ſtiff and ſwoln.

It is unneceſſary to proceed with the detail of this caſe, which terminated in the recovery of the patient. The circumſtances related fully evince that a miliary eruption may occur in a cold ſeaſon of the year; with a free acceſs of air; and under an antiphlogiſtic method of cure.

COLUMBO ROOT.

THE efficacy of the Columbo root in a variety of diſorders, has now been experienced by the public; and it affords me great ſatisfaction that I have been inſtrumental in exciting the attention of Phyſicians to a remedy of ſuch acknowledged utility. But the high price which this root bears; the general demand for it; and the ſmall quantity that remains of it in England, will occaſion ſuch adulteration of it as may prove very injurious to its reputation. Beſides, the bitterneſs of the Columbo is much impaired by keeping; it is liable to rot, and to become worm eaten; and from theſe cauſes it may loſe all its medicinal virtues.

I have ſeen many ſpecimens of it, which muſt fail, when adminiſtered, to anſwer the views of the preſcriber. Whether we are likely to obtain any ſufficient ſupplies of this remedy, I am uncertain. Applications have been made to the captains of ſeveral ſhips, bound to India; but our ignorance of the natural hiſtory of the root is a great obſtacle to the acquiſition of it. The practitioners of phyſic in the Eaſt Indies cannot, without danger, proſecute botanical reſearches in a climate where all nature ſwarms with life. And they employ the natives of the country to collect their ſimples; whoſe intereſt it is to conceal the manner of their production, and their place of growth. Mr. Ives, in his voyage to India, mentions the columbo root in the following terms, page 482. "*Radix Indicus Amarus*. This is the root of the *Cocculus Indicus*. When quite freſh it is an "emetic; when dry a cathartic." Theſe characters are ſo oppoſite to the known qualities of the columbo root, that I apprehend Mr. Ives muſt be miſtaken in his account of it. And I have deſired Doctor Lind, of Haſlar hoſpital, who is perſonally acquainted with that gentleman, to make farther enquiries of him concerning the *Cocculus Indicus.* The Doctor has executed my commiſſion, with the moſt obliging and friendly attention. But he has not been able to obtain, either from Mr. Ives or Mr. Bogue, who had the charge of the naval hoſpital in India, and who is lately returned from thence, any ſatisfactory information.

ANGINA PECTORIS.

IN November 1773, I was deſired to viſit a gentleman near Knutsford, in Cheſhire, aged upwards of fifty; who had been for ſeveral years ſubject to frequent attacks of a moſt alarming and oppreſſive

preſſive ſenſation in his breaſt, which he knew not how to deſcribe. This ſymptom was attended with a pain about the middle of the *ſternum*, inclining to the left ſide; and he was generally affected, at the ſame time, with a pain in his left arm where the deltoid muſcle is inſerted. As I viſited the patient only once, and took no notes of his caſe, I cannot give a minute detail of it, and muſt content myſelf with ſaying, that I apprehended his diſorder to be what Dr. Heberden hath ſo accurately deſcribed under the name of *Angina Pectoris*. Various anodyne and antiſpaſmodic remedies were preſcribed; but theſe produced only a temporary alleviation of his complaints. And it was obſerved, that nothing afforded ſuch inſtantaneous eaſe, during the paroxyſms of his diſorder, as venaeſection or vomiting. In July 1774, he died; and his body was examined by Mr. Allen, an ingenious ſurgeon in Knutsford,

ford, who has favoured me with the enſuing account of the diſſection.

The left lobe of the liver was conſiderably enlarged, and full of indurated, white, tumors; and nearly one half of the right lobe was beginning to be affected in a ſimilar manner. The gall-bladder was diſtended with bile; the ſtomach was hard and ſchirrous, as far as it was in contact with the liver; the lungs were pale and livid; and the blood-veſſels as diſtinct as if they had been injected with Pruſſian blue. The heart and *aorta deſcendens* were in a ſound ſtate; very little water was found in the pericardium, or mediaſtinum; and there was nothing preternatural in the appearance of the diaphragm.

This gentleman had lived freely, but was not ſubject to the gout.

Dr. Heberden has favoured me with

the following remarks upon this caſe. "The diſſection of this ſufferer by the *angina pectoris,* as well as that of a few others, which I have heard of, teaches us, that the diſeaſe is neither owing to inflammation, nor to any mal-conformation of the parts. We muſt not therefore ſeek for the cure amongſt the means which lower the *vis vitae*; and we need not deſpair of finding it elſewhere. But we ſhould not expect to find it very ſoon, when we conſider how little ſucceſs has attended all our ſearches after a remedy for the gout, and for ſome other diſtempers, with whoſe natures we have had, for ſome thouſand years, ſuch abundant means of being acquainted."

SOLUTION OF WATER IN AIR.

AN eminent Philoſopher informed me ſome time ago, that the ſolvent power of air on water, is a diſcovery of a much older date than is commonly ſuppoſed; and that it was well known to Dr. Edmund Halley, about the beginning of the preſent century. The following quotation, which I have extracted from the ſecond volume of Lowthorp's abridgement of the Philoſophical Tranſactions, will ſufficiently evince the truth of this aſſertion.

"VAPOURS being raiſed by warmth, "let us, for a firſt ſuppoſition, put, that "the whole ſurface of the whole globe "were all water very deep, or rather "that the whole body of the earth were "water, and that the ſun had his di"urnal courſe about it; I take it, that "it would follow, that the air of itſelf "would imbibe a certain quantity of a"queous vapours, and retain them *like* "*ſalts diſſolved in water*; that the ſun "warming the air, and drawing a more "plentiful vapour from the water in the

" day time, the air would ſuſtain a great-
" er proportion of vapours, as *warm wa-
" ter will hold more diſſolved ſalts*; which
" upon the abſence of the ſun, in the
" nights, would be all again diſcharged
" in dews; *analogous to the precipitation
of ſalts on the cooling of liquors* (g).

AFFECTIONS OF THE EYES.

Mr. WARD, aged forty-eight years, formerly an Attorney, and a very ſtudious man, has been gradually loſing his eye-ſight during twenty years; and is now capable only of diſtinguiſhing light from darkneſs. The pupils of his eyes are more dilated than is natural, in the dark; and they are contracted in an e-

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(g) See Lowthorp's abridg. of Phil. Tran. vol. II. p. 127.

qual proportion in a ſtrong light. *There* is a ſmall ſpeck or obſcurity juſt diſcernible in the centre of the pupil of the left eye, like an incipient cataract, but inſufficient to affect viſion in a material degree. He has ſuffered no pain in his eyes; and can aſcribe his blindneſs to no other cauſe, but cloſe ſtudy and application. Can this diſeaſe be denominated a *gutta ſerena?* It ſeems to be ſeated in the *retina*; but from the ready contraction, and dilatation of the pupils, it ſhould appear that the nerves are ſtrongly affected by the ſtimulus of light, and yet are incapable of conveying to the mind the uſual ſenſations produced by luminous objects. In palſies, ſuch partial affections of the nerves ſometimes occur.

The Rev. Mr. S. of Rochdale informs me that the pupils of his eyes do not ſenſibly contract in the light, or dilate in the dark. And he obſerves that much more light is requiſite to him for diſtinct viſion, than to others, whoſe eyes are differently formed. In the duſk of the evening, when others ſee tolerably well, he can ſcarcely diſtinguiſh any objects. The pupils of his eyes are very ſmall.

[illegible] Onan in [illegible] the same
Situation from the same Cause.

ASYLUM OR LOCK HOSPITAL.

AN aſylum or lock hoſpital, for the reception of female patients labouring under the venereal diſeaſe, has been lately eſtabliſhed at Mancheſter; and it is to be wiſhed that ſo laudable an example may be followed in other places. To ſhew the utility of ſuch inſtitutions; and to obviate the objections which have been made to them, the following advertiſements were written, and are prefixed to the two reports of the hoſpital above mentioned.

MANCHESTER 1774.

WHOEVER reflects on the variety of diſeaſes to which the human body is incident, will find with concern, that a conſiderable part of them are derived from immoderate paſſions and vicious indulgences. Sloth, intemperance, and irregular deſires, are the great ſources of evil, which contract the duration, and imbitter the enjoyment of life. But humanity, whilſt ſhe mourns over the vices of mankind, incites us to alleviate the miſeries which flow from them. The private hand of charity is never ſhut, when ſickneſs complicated with poverty preſents itſelf; and hoſpitals are eſtabliſhed in every part of the kingdom, for the reception of the wretched, whether innocent or guilty.

A NEW inſtitution founded on theſe

benevolent principles, conſonant to ſound policy, and favourable to the intereſts of virtue, now claims the attention, and encouragement of the public: the object of it is to provide relief for a loathſome and painful diſtemper, often fatal when neglected; but which admits of an almoſt certain cure, when the patient is under confinement, and ſubject to proper regulations. This aſylum, it may reaſonably be hoped, will withdraw from their haunts thoſe wretches, who ſeduce unwary youth, contaminate them with diſeaſe, ſpread wide infection, and entail ſhame and miſery on a feeble poſterity. To the penitent ſufferers it will afford a pleaſing refuge, will give opportunity to confirm their wavering reſolutions, and will reſtore them to health, to peace, and uſefulneſs. Happy will the governors be in diſmiſſing ſuch with this benevolent injunction,

GO, AND SIN NO MORE.

1775.

1775.

THE public has been already informed of the nature and deſign of this excellent INSTITUTION; which is founded on the wiſeſt *policy*, approved by *reaſon*, and recommended by *humanity*. It provides relief for a painful and loathſome diſtemper, which contaminates in its progreſs, the innocent as well as the guilty, and extends its baneful influence to future generations. It reſtores to virtue and religion thoſe votaries whom pleaſure has ſeduced, or villainy betrayed; and who now feel, by ſad experience, that ruin, miſery, and diſgrace, are the WAGES of ſin.——Over ſuch objects, pity ſheds the generous tear; auſterity ſoftens into forgiveneſs; and benevolence expands at the united pleas of frailty, penitence, and wretchedneſs.

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Price Two SHILLINGS and SIX-PENCE ſewed.

A

FATHER's INSTRUCTIONS
TO HIS
CHILDREN:

CONSISTING OF
TALES, FABLES,
AND REFLECTIONS;
DESIGNED TO PROMOTE
THE LOVE OF VIRTUE,
A TASTE FOR KNOWLEDGE,
AND
AN EARLY ACQUAINTANCE WITH
THE WORKS OF NATURE.

By THOMAS PERCIVAL, M.D. F.R.S. & S.A.

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AN

APPENDIX.

A LETTER TO DR. PERCIVAL FROM WILLIAM SAUNDERS, M. D. PHYSICIAN TO GUY'S HOSPITAL; CONCERNING THE SOLUTION OF STONES OF THE BLADDER BY FIXED AIR.

DEAR SIR,

I HAVE at laſt found leiſure to comply with your requeſt, that I ſhould tranſmit to you an account of ſome important diſcoveries and improvements which I have made in applying the uſe of fixed air, or more properly the mephitic acid to the practice of medicine, and more eſpecially for the purpoſe of diſſolving the human calculus. The public are already much indebted to you for that ſpirit of inquiry which you have ſo ſucceſsfully directed in recommending this uſeful medicine, in pulmonic diſorders, gangrenous ſore throats, and malignant fevers, and it affords me no ſmall pleaſure, that my experiments have not only met with your approbation, but have been confirmed by your proſecuting the ſame ſubject with equal ſucceſs, ſo as to put it out of all doubt that we are now in poſſeſſion of a more efficacious and pleaſant ſolvent for the human calculus, than any hitherto in uſe, and that it reaches the urinary paſſages in its full force communicating its ſolvent power to the urine. I ſhall hope likewiſe to make it appear, that it poſſeſſes every advantage over the lixivial and other boaſted ſolvents now in uſe, it being ſalutary to the conſtitution and checking that tendency to putrefaction which is ſo prevalent in calculous habits, and which is ſo much increaſed by alkaline ſalts and the ſeptic regimen, generally recommended along with them.

I WAS firſt led to proſecute this ſubject from the following experiments of Dr. Hales, and which I have repeated with the ſame ſucceſs.

“ THOUGH I have not herein ſucceeded ſo far, as to encourage any one to “ attempt the diſſolving therewith gra- “ vel-ſtones in the bladder: yet I thought “ it might not be improper to give an “ account of the ſmall progreſs I had “ made herein; ſince it might poſſibly “ be a ſtep towards the happy and im- “ portant diſcovery, by exciting and en- “ gaging others in the ſame purſuit; who “ among the infinite variety of menſtru- “ ums that may be compounded, may “ haply hit upon ſome, which may more “ eaſily diſſolve moſt gravel-ſtones at “ leaſt, if not the larger and harder “ *Calculi*. If we could make no farther “ advance than this, it would be of con- “ ſiderable benefit to mankind, by tak- “ ing away, when it firſt falls into the "bladder, the *Nucleus*, on which larger "and harder ſtones are in time formed. "And this would be effected, if with a "few injections of a ſafe and proper "menſtruum, we could only diſſolve a "ſmall part of a large gravel-ſtone, lately "fallen from the kidnies, ſo as to "make it fit to paſs off through the "*Urethra*; which it would alſo do with "more eaſe to the patient, by having "thereby its ſurface and ſharper points "ſoftened and made mucilaginous, and "ſtimulating. This is what the fermenting "mixture I am going to give "an account of, will do on ſome of the "ſofter ſtones, but not without too many "repeated injections, to make it practicable "with ſafety to the patient.

"THAT I might with the greater "accuracy and readineſs vary and adjuſt, "as occaſion required, the ſeveral proportions "of the fermenting mixtures, "I divided the capacity of ſeveral glaſs

“ veſſels, out of which I poured the li-
“ quors, into cubic inches, making
“ marks with a file on the outſide of the
“ glaſſes, at each diviſion. I divided al-
“ ſo the capacity of a large tube into
“ quarter cubic inches; it was half inch
“ diameter, and ſealed at one end. I
“ made alſo ſeveral diviſions on a ſhort
“ tube, which was quarter of an inch
“ diameter, the capacity of each diviſion
“ containing ten drops of oil of ſulphur;
“ ſo that by dipping one end of this
“ tube in liquor to any of theſe marks,
“ and then ſtopping the other end with
“ my finger, I could readily take up ten,
“ twenty, thirty, forty or fifty drops, or
“ any intermediate number.

“ I WILL now give a ſhort account of
“ ſome of the principal experiments I
“ made; in doing of which I did not
“ confine myſelf to ſuch mild mixtures,
“ as might probably not be injurious to
“ the bladder; but choſe to begin with

" the ſtrongeſt fermenting mixtures, in " hopes that if I ſhould find any of theſe " would diſſolve the *Calculus*, by gradu" ally weakening and lowering ſuch mix" ture, I might poſſibly bring it to ſuch " a degree of mildneſs, as might make " it not injurious to the bladder, and " yet retain in ſome meaſure its diſſolv" ing quality. Or if I ſhould not be ſo " happy as to ſucceed ſo far, yet I thought " it moſt probable, that I might find " diſſolvents, among theſe ſtronger mix" tures, which might at leaſt give ſome " farther inſight into the nature of the " *Calculus*.

EXPERIMENT II.

" 1. A CUBIC inch of oil of vitriol, " and double its quantity of water, when " mixt together, made ſo hot a ferment, " that I could hardly bear to hold my " hand at the bottom of the bolthead;

"yet it had no effect on a piece of the "hardeſt kind of *Calculus*. And it was "the ſame when the heat and ferment was "renewed by throwing in ſome filings of "iron."

"2. The like proportions of oil of vitriol and water, with ſeveral kinds of "powdered vitriolic ſtones or *Pyrites*, "made violent ferments, but had no effect on this very hard *Calculus*.

"3. It was the ſame with oil of vitriol, and other acid ſpirits, when poured on ſeveral alkaline bodies, ſuch as "powdered *Belemnites*, *Aſteria*, coral "and oyſter-ſhell, *&c.*

"4. But oil of vitriol mixed with "unrectified ſpirit of C. C. though it "would not diſſolve the above-mentioned very hard piece of *Calculus*, yet "with ten or twelve freſh mixtures, it "rotted and diſſolved ſeveral pretty thick "*Laminæ*, or cloves of other *Calculi*;

" which though not of ſo compact a texture as the other, yet were ſo hard, " that I could not make any impreſſion " on them with my nail: but this was " too pungent a mixture to give any " hopes that the bladder can bear any de- " gree of it.

" 5. SPIRIT of rye-bread being found " by chymiſts a diſſolvent ſo powerful " as to diſſolve ſeveral kinds of ſtones " and hard ſubſtances, and yet withal ſo " mild, that it may with great ſafety be " held in the hollow of the hand; I prepared a good quantity of it, both unrectified and rectified, and made it one " in a great variety of briſkly fermenting " mixtures, in hopes that by thus putting its parts in a briſk motion, it " might have made ſome impreſſion on " the *Calculus*, but it had none.

" 6. I MADE a preparation of tartar " of vitriol, by mixing one part of oil "of vitriol, with twice its quantity of "hot water, in which were pieces of "*Calculus* and tartar; the *Calculus* emitted bubbles, but not the tartar: then "I poured in gradually *Ol. Tart.* when "both *Calculus* and tartar emitted for "ſome minutes a great quantity of bubbles. The tartar was alſo at once diſſolved, and the *Calculus* was very rotten and brittle, but it was not of the "very hard kind; *Sal Tartar*, which is "a fixt alkali, being leſs corroſive than "ſpirit of harts-horn, which is a volatile alkali.

EXPERIMENT. III.

"1. I MADE a ſolution of it in "water, in the proportion of an ounce "of *Sal Tartar* to four of water; and "made many briſk fermentations, with "ſeveral portions of this alkaline mixture, by pouring in of the ſtrongeſt

" acid ſpirits, as ſpirit of nitre, ſpirit of " ſalt, ſpirit and oil of vitriol, and oil " of ſulphur. I found oil of vitriol and " oil of ſulphur moſt effectual to my " purpoſe; and of theſe two, I choſe " rather to make uſe of oil of ſulphur " than oil of vitriol, as being the purer " acid of the two, and leſs noxious to " animal bodies than oil of vitriol.

" 2. I FOUND, after the mixture of a " great variety of proportions of theſe " liquors, that the following were the " propereſt for my purpoſe, *viz.* one " cubic inch of water, one third of a " cubic inch of ſolution of *Sal Tartar*, " and twenty-five, or ſometimes thirty " drops of oil of ſulphur; alſo ſix cubic " inches of water, $\frac{3}{4}$ cub. of the ſolu- " tion of *Sal Tartar*, and fifty drops of " oil of ſulphur.

" 3. THESE proportions fermented " briſkly, and made air bubbles ariſe ve-

" ry faſt from the *Calculi* for eight or
" ten minutes, as would alſo ſeveral o-
" ther proportions, though I did not find
" any ſo effectual as theſe, which after ſe-
" veral freſh affuſions of them, would diſ-
" ſolve ſome *Calculi* which were hard to
" the touch. They would alſo diſſolve
" ſeveral gravel-ſtones, though not all;
" nor had they any effect on many of
" the hardeſt *Calculi*.

" 4. If air do not ariſe briſkly from
" the *Calculus*, upon pouring on any of
" theſe mixtures, the rule to adjuſt the
" proportions accurately, is to drop in a
" few drops of oil of ſulphur; if this
" addition make more air ariſe from the
" *Calculus*, it is a ſign ſome of it was
" wanting; but if more air does not
" ariſe, then it is a ſign that more ſolu-
" tion of *Sal Tartar* is wanting."

" 5. It fermented beſt, when half
" the water was poured on the ſolution
" of

" of *Sal Tartar*, and the ſpirit of ſulphur " was dropped into the other half, and " then both mixtures poured together. " Warm water was better than cold, " though it fermented longer cold.

" 6. When there was a double quantity of oil of ſulphur, I have not found " it more powerful in diſſolving; and " when the ſolution of *Sal Tartar* was " much ſtronger, the ferment was leſs.

" 7. The liquor has no effect on the " *Calculus* after the ferment is over, as I " have found by laying ſeveral *Calculi* to " ſoak in it for a whole year. So that the " effect it has on the *Calculus* while it is " fermenting, ſeems not to depend on " the fitneſs of the particles of the menſtruum to enter the pores of the *Calculus*, but rather on certain harmonic " proportions between the vibrations of " the fermented liquor, and the tone or " degree of tenſeneſs of the parts of the

" *Calculus*: juſt as when two ſtrings
" are equally tenſe, the ſtriking of one
" will make the other ſound; or, as I
" have often obſerved, the different pipes
" of an organ will make different boards
" vibrate, according to the uniformity
" there is between the tenſeneſs of the
" fibres of the ſeveral boards, and the
" tone of the different pipes.

" 8. And in like manner we may
" not unreaſonably ſuppoſe, that when
" there is the like uniformity between
" the vibrations of the fermenting liquor,
" and thoſe of the parts of the *Calculus*;
" that the *Itus* and *Reditus* of theſe vibrations
" increaſing in this caſe each
" other's force, ſome parts of the *Calculus*
" are thereby thrown off into elaſtic air.
" In confirmation of this conjecture, I
" have obſerved air to ariſe briſkly from
" a *Calculus* with twenty or ten drops of
" oil of ſulphur; and yet with fifteen
" drops little or no air aroſe, notwith-

" ſtanding the proportion of the other
" ingredients of the fermenting mixtures
" was the ſame in all three caſes.

It ſufficiently appears, from attending to theſe experiments, that the *Calculus* was diſſolved during the effervescence from the application of the fixed air; for the ſolvent power ceaſed after the effervescence was over, and the neutral ſalt formed by the combination of the acid and alkali had no menſtrual power. I was confirmed in this opinion by the two following experiments, which ſeem to me perfectly deciſive upon that ſubject.

EXPERIMENT I.

TEN grains of a human *Calculus* were put into two ounces of diſtilled water, and after ſtanding for ſome hours, there was found no diminution of its weight, and the water ſhowed no precipitation upon the addition of a ſolution of ſilver in the nitrous acid, or of a very cauſtic alkali, prepared by Mr. Lane.

EXPERIMENT II.

TEN grains of the ſame *Calculus* was added to two ounces of diſtilled water, ſaturated with fixed air; it loſt three grains of its weight, and there was a precipitation upon the addition of the cauſtic alkali.

This laſt experiment has been repeated upon different *Calculi*, and they have been always found diſſolved in a greater or ſmaller proportion, admitting of that variety which might be expected in the ſolubility.

These two experiments are ſufficient to prove the ſolubility of the human *Calculus* in the mephitic acid, and, together with ſuch as you have made, ought to rouſe and excite the induſtry of medical people to a ſubject that promiſes ſuch ſingular advantages to mankind.

Dr. Hales, whoſe candour and judgment in conducting experimental enquiries cannot be too much admired, was entirely ignorant of the chemical properties of fixed air, and its effects, in combination or mixture with other bodies. I was encouraged in favouring the opinion, of its poſſeſſing a very univerſal ſolvent power, from the experiments of Mr. Cavendiſh and Mr. Lane, and from its appearing, when pure and ſeparate, in a permanent ſtate of elaſtic vapour, and its readineſs to return to that form from its ſtate of mixture, confirmed me more in this opinion; it being a general principle in chemiſtry, that the power of ſolution and mutual combination, is greatly aſſiſted by the bodies employed being made to aſſume the ſtate of vapour. The very ingenious experiments of Mr. Bewly, as related in Dr. Prieſtley's ſecond volume on air, have thrown much light upon the chemical hiſtory of this body, and have put it beyond all doubt, that it is an acid of a particular kind, poſſeſſing a weaker attraction to alkalis, calcareous earths, magneſia, and other bodies, than any other acid; and that, therefore, in common with other acids, it loſes its ſolvent power in mixture or combination with other bodies. It was neceſſary to make this obſervation, in order to explain, why cauſtic alkalies and quick-lime loſe their active powers in combination with this acid; and that, therefore, mild alkalies and calcareous earths ought rather to be conſidered as, in ſome degree, in a ſtate of neutrality with this acid, whoſe power of attraction is ſo weak, and whoſe tendency to reſume its proper elaſtic form is ſo great, that it does not totally deſtroy the diſtinct and original properties of alkalies, or earths, with which it is united. I was much pleaſed with my ſucceſs on this ſubject, becauſe I had diſcovered, from various chemical trials, on the human calculus, and the urine of perſons labouring under that diſeaſe, that there was a diverſity in the nature and properties of their component elementary parts, and that the ſtrongeſt lixivium was inſufficient to diſſolve ſome calculi, which readily yielded to the application of fixed air. Of this fact I was particularly informed by my friend Mr. Lane, who has directed the public to the beſt method of preparing the lixivial ſolvent, and who has likewiſe engaged his attention to many uſeful and ingenious inquiries upon this ſubject.

It appears, from your experiments, that you found fixed air a very univerſal menſtruum for the human calculus; from which I am diſpoſed to think, that you have not extended your experiments to that variety which may afterwards occur. I am perſuaded, that in all human calculi there is a very large proportion of animal mucus, and more particularly in thoſe of a laminated ſtructure; while ſuch as put on a more ſhining chryſtalline form contain a larger proportion of ſaline and earthy matter.

It is impoſſible to determine abſolutely in what caſes one ſolvent ſhould be preferred to another, until the urine and its contents have been properly examined; and as it is ſufficiently proved by your own obſervations, that fixed air is conveyed by the powers of circulation unchanged to the bladder, impregnates the urine, and communicates to it its ſolvent power, we may reaſonably conclude, that when the urine of a particular perſon impregnated with fixed air, does not depoſit its terreſtrial parts, or, when it has depoſited them, the fixed air can be made to rediſſolve them, the mephitic ſolvent is beſt adapted to ſuch a conſtitution. If on the other hand, ſuch be the nature of the *Calculus* concretions, that they conſiſt chiefly of earthy matter laminated and cemented by animal mucilage, the lixivial ſolvent will exert a more powerful operation in ſoftening and deſtroying the coheſion of the *Calculus* in ſuch a manner as ſometimes to promote the ſeparation of its parts, and thereby facilitate its evacuation.

I AM confirmed in this opinion from having found by experiment, that the mucus which is diſcharged ſo plentifully by calculous patients, is readily ſoluble in the cauſtic lixivium, and that in attempting to diſſolve the human *Calculus* in the ſame lixivium, I generally perceived that it was rendered ſofter, and its texture diſcharged without any diminution of its earthy parts. I think it highly probable that advantages might ariſe from alternating the uſe of various ſolvents, and that after ſufficient trials have been made by the lixivial ſolvents, in many caſes the mephitic acid might be employed with additional advantages, the former diminiſhing the coheſion, and thereby facilitating the menſtrual power of the latter.

THIS method of preſcribing will obviate the objections which might ariſe from their being taken at the ſame time, becauſe they enter into that union with one another, as to diminiſh, if not perfectly to deſtroy their powers of ſolution. If a more powerful and active ſolvent than any hitherto known ſhall be diſcovered, it is highly probable that ſuch a diſcovery can only be made by a rational and chymical inquiry into the powers of different bodies of combining with the contents of the urine, and preſerving them in a fluid ſtate out of the body. It is well known that all the empirical remedies now in uſe, and recommended for diſſolving the human *Calculus*, are alkalis rendered more or leſs cauſtic by a combination with quicklime, and that in order to diſguiſe them, they are variouſly impregnated with bitter and other vegetable ſubſtances, and variouſly tinctured and coloured by different bodies, which can communicate to them no additional powers. To ſome an opiate is added, to take off that irritation which lixivial medicines produce in the urinary paſſages. The lixivial remedies employed for diſſolving the human *Calculus* are extremely deſtructive to ſome conſtitutions. There are inſtances of their having produced the moſt putrid diſeaſes, and increaſing a diſpoſition to ſcorbutic complaints.

THEY ſometimes bring on the moſt dangerous hæmorrhages, and the regimen employed, being chiefly animal diet; the putreſcent ſtate of the fluids is thereby greatly increaſed. I have likewiſe frequently obſerved ſo much irritation and pain, as to produce conſiderable inflamation in the bladder by the ſame means, If therefore future trials with the mephitic acid ſhall meet with the ſame ſucceſs experienced both by you and myſelf, it ought to be very generally preferred, becauſe the regimen beſt adapted to aſſiſt its operation is of the vegetable kind, and the free uſe of wine and fruits, the moſt powerful antiſeptics may be at the ſame time admitted in the form of diet; beſides it appears from Dr. Macbride's experiments, that the mephitic acid itſelf is the moſt powerful remedy in putrid and ſcorbutic diſorders, and may therefore be employed with the greateſt advantage in reſtoring a patient to perfect health, who may have ſuffered by perſevering in the uſe of the lixivium.

IT now remains, that I ſhould ſay ſomewhat on the beſt method of preſcribing this uſeful remedy. In the firſt place, the patient ſhould be directed to prefer the uſe of ſuch water as contains it in the largeſt quantity, ſuch as Briſtol water, Seltzer water, Rathbone place water; and as it cannot be difficult to find water of this kind in moſt places, it ſhould be made one chief article of their diet. All hard water which becomes ſofter by being expoſed to the air or even by boiling, and depoſits a calcareous earth is of this kind, and the acidulæ of all countries have been conſidered as the moſt powerful lithontriptics.

At Chiſelhurſt, in Kent, on the eſtate of Lord Camden, there is a large ſpring of water which contains a very large proportion of fixed air, it is very hard when immediately taken from the ſpring, it however becomes ſoft by being long expoſed to the air, ſo as to diſſolve ſoap for the purpoſe of waſhing, and is employed and preferred for all culinary purpoſes;

its power of diſſolving marble and other ſtony matters is ſo great, that it cannot be confined in veſſels of theſe materials. It has been found, on repeated trials, that it acted upon the human *Calculus*; I ſhould therefore recommend the uſe of this or any ſimilar water in preference to any other. Of theſe material facts I was particularly informed by his Lordſhip. The ſkilful Phyſician may ſuggeſt a great variety of forms in which this ſalutary acid may be introduced. The moſt eligible manner of preſcribing it is by impregnating water with it in the manner recommended by Dr. Nooth, with his apparatus improved by Mr. Parker of Fleet Street. Saline draughts may be taken in their ſtate of effervefcence, and it may be ſtill more agreeably preſcribed in the form of briſk vinous liquors, ſuch as Champagne, Perry and the like.

I wish it however to be underſtood that the united obſervations of many practitioners on its internal uſe are ſtill neceſſary to eſtabliſh a very univerſal ſolvent of *Calculi* in the human bladder, and I give my conſent to the publication of this letter, more with a view of exciting a general inquiry into the powers of a probable remedy, than of confidently boaſting of the ſuperior efficacy of this acid, as eſtabliſhed by pathological obſervations; at the ſame time ſome caſes have occurred, which might lead to the moſt favourable opinion of its efficacy, but I rather chooſe to poſtpone the publication of theſe till its virtues ſhall be better aſcertained by farther trials, fully ſenſible of the fallacy and difficulty attending obſervations made, and concluſions drawn from a few caſes.

We ſhall be uſefully employed if by a rational inquiry of this kind, we can extricate the preſent practice, in ſuch caſes, from the hands of empirics, and prevent a deluded public from blindly confiding in the boaſted remedies or *noſtrums* on this ſubject, all of which, ſo far as I have examined by analyſis, are the lixivium in diſguiſe; a medicine, in my opinion, very unfriendly to the conſtitution, by deſtroying acidity, and, probably proving ſeptic to the body by neutralizing fixed air, and entering into mixture with it.

I am,

DEAR SIR,

With much Eſteem and Affection,

Your moſt obliged,

and humble Servant,

Jeffries Square,
St. Mary Axe,
LONDON,
Feb. 1. 1776.

WILLIAM SAUNDERS.

A SECOND LETTER FROM DR. SAUNDERS TO DR. PERCIVAL, ON THE PREPARATIONS OF LEAD, AND OTHER CHEMICAL SUBJECTS.

DEAR SIR,

BEING informed that you are preparing for the preſs, a Volume of Eſſays on philoſophical and medical ſubjects on the ſame plan with thoſe already publiſhed, I am happy in this opportunity of communicating to you, a few ſtriking facts and experiments on ſome of the preparations of lead, a ſubject which has already engaged your attention. Much has been written on the efficacy of the preparations of lead, on external application, and their operation and effects are ſo well underſtood by ſurgeons, that little remains to be ſaid upon this ſubject; it being however generally admitted, that the *Acetum Lythargyrites* or Goulard's extract is in its operation and powers the ſame as the *Saccharum Saturni*; I am deſirous of correcting this popular error, by explaining the difference between theſe two preparations.

METALLIC bodies acquire their cauſticity by an union with acids, with which they enter into a ſtate of mixture; the activity is proportioned to the quantity of acid and the degree of ſolubility in the metallic ſalt. The variety in this reſpect in ſome metallic ſalts is ſo great, even where the acid in combination is the ſame, that the cauſticity acquired by a moderate proportion of metal is almoſt deſtroyed, when a larger proportion is added: This is illuſtrated by attending to the difference between corroſive ſublimate and calomel, which are both pre-

parations

parations of mercury with the ſame acid. This reaſoning will apply to the ſubject of lead.

In the preparation of the *Acetum Lythargyrites*, the acid is fully ſaturated with lead; in the preparation of the ſaccharum ſaturni, the acid is in a much larger proportion to the lead. The *Acetum Lythargyrites*, when diluted by the pureſt diſtilled water, gives out a copious precipitation which, from experiment, I find to be Ceruſſe. The *Saccharum Saturni* remains diſſolved in diſtilled water, and is therefore applied topically in a ſtate more immediately active, both from its greater proportion of acid, and its preſerving its ſolubility under high degrees of dilution. I find from experiment that, by adding a very ſmall proportion of diſtilled vinegar to the *Aqua Saturnina* of Goulard, the white precipitate is rediſſolved, and that the ſolution procured in this manner is more active, but leſs adapted to remove inflammation, and abate irritation, as a ſedative, than the *Aqua Saturnina* itſelf. I was firſt led to apply to this ſubject from an averſion to the uſe of turbid liquors, eſpecially when the precipitation is produced by the pharmaceutical treatment of chymical mixtures. I am, however, perfectly convinced, that no degree of dilution of *Saccharum Saturni* will anſwer the many valuable purpoſes to be obtained from the uſe of the *Acetum Lythargyrites*. In the operation of medicines on the human body, a ſlow and gradual action is often to be deſired, in preference to a more immediate operation from the ſame remedy applied in a more ſoluble form. It is upon the ſame principle that the *Flores Zinci*, when diffuſed in water, in many caſes, produce a better effect than a ſolution of the *Vitriolic Album* in any ſtate of dilution, and that the *Kermes Mineral*, and ſome other preparations of antimony of a ſlow ſolubility, produce a more laſting operation, and poſſeſs more powers than even the *Tartar Emetic*, except in ſuch caſes where immediate and active evacuations are required, as in the beginning of fevers and acute diſeaſes. Water alone therefore in the caſe of the *Aqua Saturnina* proves a precipitant of lead by attracting the acid, and reducing the preparation to a ſtate of Ceruſſe, an intermediate ſtate between Lead and the *Saccharum Saturni*, ſo that Ceruſſe diffuſed in water more nearly reſembles the *Aqua Saturnina* of Goulard, than a ſolution of the *Saccharum Saturni* does. There is however an advantage in external application from the uſe of powdery bodies, in their ſtate of precipitation, becauſe they are in a more ſubtle form than any body can be rendered by mechanical triture. I have ſometimes been of opinion, that various chemical mixtures are formed by the union of the ſame metal in its application to different proportions of the ſame acid, and that *Calomel* may be conſidered as the union of Mercury with *Corroſive Sublimate,* in which the acid was ſo much attracted and engaged, that it entered into a very imperfect union with the additional quantity of Mercury in *Calomel*; and that therefore the Mercury employed which produces Calomel, diminiſhes the activity of Corroſive Sublimate without acquiring ſolubility itſelf, and without loſing much of its own phlogiſton; hence the precipitates from Calomel and Corroſive Sublimate by alkaline ſubſtances differ ſo eſſentially in their nature. In the ſame manner the *Saccharum Saturni* may be conſidered as a union of Ceruſſe with Vinegar, whereas Goulard's *Acetum Lythargyrites* is a union of Lead with Vinegar.

To the ſame principle may be referred the power of fixed air in re-diſſolving calcareous matter, after it had proved, in a ſmaller proportion, a precipitant for quick-lime. So that although chalk may be conſidered as a combination of quick-lime and fixed air; calcareous matter diſſolved in water by fixed air is a union of chalk and fixed air. We even find that although quick-lime attracts fixed air ſtronger than the cauſtic fixed alkali; yet the cauſtic fixed alkali attracts fixed air more ſtrongly than chalk does, and therefore precipitates chalk held in a ſtate of ſolution by fixed air. This will probably beſt explain why the cauſtic alkali ſhould prove a precipitant of calculous matter diſſolved in the mephitic acid. I have mentioned thoſe facts with a view to illuſtrate that it is a principle in chymiſtry, that various mixts are formed from the combination of two bodies in different proportions to one another. It is upon a ſimilar principle that metallic ſalts are rendered leſs active by abſtracting their acid, either by attraction or calcination. An attention to theſe circumſtances derived from a knowledge of the chymical hiſtory of bodies may lead to ſome future improvements in the pharmaceutical treatment of many valuable remedies, and enable us to render chymical preparations more or leſs active, or more or leſs ſoluble, as the indications of cure may ſeem to require.

EXPERIMENTS ON DYING BLACK, BY MR. JAMES CLEGG, OF REDIVALES, NEAR BURY. IN A LETTER TO DR PERCIVAL.

DEAR SIR,

LIME having been proved to increaſe the ſolvent power of water, upon aſtringent vegetables, for medical purpoſes, I was deſirous of knowing if it would be equally uſeful in the art of dying black; to this end I made the following experiments.

EXPERIMENT I.

FOUR penny-weights of each of the following aſtringents; *viz.* Galls, Sumach, Oak Bark, Biſtort Root, and

Logwood, were boiled during ten minutes, in half a pint of pure river water; upon mixing the decoctions with a ſaturated ſolution of martial vitriol, in the proportion of $\frac{1}{3}$ of the ſolution to $\frac{2}{3}$ of the decoction, they ſtruck colours differently inclining to blackneſs, in the following order; *viz.* Oak Bark, Biſtort Root, Sumach, Galls. I then boiled the ſame weight of all the aſtringents, in the ſame quantity of lime-water; and upon mixing them as above, the colours they produced were inferior to thoſe with plain water, the aſtringency of the logwood, or whatever gives it the property of ſtriking black with green vitriol, was entirely deſtroyed; it produced not the leaſt blackneſs with any quantity of vitriol.

EXPE-

EXPERIMENT II.

FOUR penny-weights of each of the aſtringents above-mentioned, were triturred in plain water, and four others in lime-water; the meaſures of water uſed were equal to thoſe left, after boiling, in the laſt experiment; and, upon being mixed with martial vitriol as in the laſt experiment, the colours produced, by this means, were ſuperior to thoſe produced by boiling. Thoſe tritured in lime-water were judged to be the deepeſt, which agrees with Mr. Henry's experiments; but we muſt again except the Logwood, which gave no colour by trituration, more than by boiling in lime-water.

EXPERIMENT III.

ALL the above mixtures, having been written with as inks, and expoſed ſix months to the air; thoſe boiled in lime-water had faded much; thoſe triturated in lime-water, and in plain water, had faded a little; thoſe boiled in plain water evidently preſerved their colour beſt.

Upon ſlightly rubbing the faded writing, with a freſh aſtringent liquor, they recovered their original blackneſs; by which it appears, that it was the aſtringent parts of thoſe Inks which had failed.

Does it not appear, by theſe experiments, that, though lime-water tends to deepen the colour produced by ſome aſtringents and martial vitriol, it by no means adds to the duration of thoſe colours;

lours; and as lime-water, either by trituration or coction, entirely deſtroys the property, in logwood, of ſtriking black with martial vitriol, it can by no means be of ſervice, in the black dye, where logwood is a material ingredient.

DOES it not alſo appear, that a ſlight boiling is preferable to trituration, for the purpoſes of dying, when a durable colour is wanting.

HAVING obſerved a ſolution of iron, in a *vegetable* acid, ſtruck a deeper black, upon mixture with an aſtringent, and produced its effect much more expeditiouſly, than a ſtronger ſolution of martial vitriol; it occurred to me, that the iron, being more ſlightly combined with the vegetable acid, than with the vitriolic, made it more eaſy, for the aſtringent matter to decompound the former, and produce an ink; if this was the caſe, I ſuſpected, that lime-water deepened the colour of aſtringent and chalybeate mixtures, not ſo much by its action upon the aſtringent, as upon the chalybeate, the lime uniting with the ſuperabundant acid, and leaving the iron, with ſo much of the acid, as is neceſſary for the formation of an ink, to be more eaſily attacked by the aſtringent matter of the vegetable.

But if this theory was well founded, it followed, from analogy, that any ſubſtance, which had a greater affinity with the vitriolic acid than iron had, would produce the ſame effect, in ſome degree, as lime. To determine this:

EXPERIMENT IV.

I took two veſſels, containing equal meaſures of a ſtrong aſtringent liquor, compoſed of galls and logwood; into one veſſel I put a ſmall quantity of pearl aſhes;

es; the other remained as a ſtandard. Pieces of linen and cotton cloth, after maceration in theſe liquors, were thrown together into a ſtroug ſolution of copperas; they were ſoon after taken out, and waſhed in cold water; when dry, the pieces prepared in aſhes were, all of them, much deeper than the others.

I MADE uſe of different kinds of pearl and pot aſhes, as well as many kinds of aſtringents; the aſhes had the ſame effect, whatever aſtringent was made uſe of, and the ſtrongeſt alkali always produced the deepeſt colour; and though aſhes, uſed with an aſtringent, always gave a deeper black, than the ſame aſtringent without aſhes, yet logwood, which without aſhes gave not ſo deep a colour as galls with them, gave a much deeper black than galls with the ſame addition.

THERE was a remarkable difference, in this caſe, betwixt lime and aſhes, in their effect upon logwood; with lime it gave no blackneſs, but with aſhes it produced a deeper black, than any other aſtringent I made uſe of.

BEING deſirous of trying the duration of colours, produced by aſtringents, in which different quantities of pearl aſhes had been diſſolved;

EXPERIMENT V.

IN two pints of river water, I boiled one ounce of logwood, during ten minutes; I then added half an ounce of Aleppo galls, and boiled them together ten minutes longer; the liquor having ſtood to cool, was decanted off, and divided into ſix equal quantities. No. 1 remained as a ſtandard; into No. 2 I put ſix grains of fine pearl aſhes; No. 3 twelve grains; No. 4 eighteen grains; No. 5 twenty-four grains; No. 6 thirty grains;

to ſix drops of each of theſe liquors, I added two drops of a ſaturated ſolution of copperas; No. 2 and 3 ſtruck a deep black; No. 1 and 4 black, but inferior to 2 and 3; No. 5 a brown black, No. 6 brown.

From this experiment it appears, that No. 5 and 6 were ſpoiled by an over proportion of aſhes. Before I had the pleaſure of ſeeing your experiments, wherein you demonſtrate, that a quantity of acid enters into the compoſition of ink, I imagined the alkali decompounded the copperas too ſuddenly, and diſengaged the iron faſter, than the aſtringent matter could unite with it.

But, moſt probably, the alkali neutralized too great a portion of the acid.

All theſe writings having been now expoſed ſix months to the air, in No. 5

and 6 the blackneſs is quite deſtroyed, No. 4 is ſomething faded, No. 1, 2, 3, remain nearly as they were, No. 2 and 3 being ſtill ſuperior to the ſtandard.

I am,

Dear Sir,

Your moſt obliged,

humble Servant,

Redivalls,
May 18, 1773.

JAMES CLEGG.

PROPOSALS FOR ESTABLISHING MORE COMPREHENSIVE AND ACCURATE PARISH REGISTERS, COMMUNICATED TO DR. PERCIVAL BY THE REV. MR. DADE.

RALPH BIGLAND, Eſqr. Norroy King at Arms, obſerves, in his pamphlet publiſhed a few years ago, that "the neceſſity of proper records for aſ-" certaining the marriages, births, bap-" tiſms, deaths and burials of perſons " within their reſpective pariſhes, is " abundantly evident from a tranſient " view of our antient hiſtory, which for " want of proper names, and real dates " and family connexions occaſionally to " be referred to, is often times rendered " perplexed and unintelligible, and ſome-" times altogether inconſiſtent even with " its own chronology."

To remove this defect, Thomas Cromwell, afterwards Earl of Eſſex, being the King's Vicar General, in the year 1338 iſſued out an order to the clergy throughout England, that in their reſpective pariſhes a public regiſter ſhould be kept for the above purpoſes. How far the intentions of that Miniſter of State are really anſwered, is evident from the incorrect manner in which entries are too generally made. It has been long wiſhed that the utility of pariſh regiſters was thoroughly inveſtigated, that the defects in making the entries were pointed out, and ſuch a plan laid down as might not only be uſeful, but eaſily applied to practice.

Whether the preſent form, with the obſervations upon it, contributes to elucidate any of theſe points, the public will eaſily determine.

Each page is divided into ſix columns; *the firſt*, in the regiſter for baptiſms, contains in large characters the chriſtian name: in the *ſecond column* is the ſurname and ſeniority of the infant, alſo in large characters. The utility of this diſpoſition will appear to any perſon who has examined pariſh regiſters with a degree of accuracy. Leſt the object of our enquiry ſhould eſcape us, how frequently are we obliged to undergo the toil of traverſing every line in each page, written perhaps in ſmall characters, improperly ſpelt, and in a hand ſometimes ſcarcely legible; whereas according to the preſent form, the reader will be able, with one glance of an eye, to run over the ſeveral names in each page; and will examine in a few minutes, what otherwiſe would take ſeveral hours to accompliſh.

In the preſent form it is hoped that care has been taken to identify the perſons: for when we are told that Robert Lutton, James Creyke, and Elizabeth Dealtrey were baptized; or that William

Strickland, Mary Strangways and Richard Heblethwayte, were buried on ſuch a day, in a ſucceſſion of years, how ſhall we inform ourſelves whether the parties were infants, adult, or aged, married or ſingle, of what profeſſion, or how they ſtood related; circumſtances we are too apt, at the time of recording thoſe particulars, to think of no moment, becauſe their conſequences are remote. Nor are our inquiries more gratified in finding John ſon of William Fairfax, Mary daughter of Thomas Beckwith, and James ſon of Robert Anderſon, baptized; or Mr. John Grimſton, Mrs. Jane Turner, and James ſon of William Fountaine were buried on ſuch a day. Was there no neceſſity for carrying our reſearches further than twenty or thirty years, the defect might be ſupplied by the teſtimony of living witneſſes, though perhaps even then not without much trouble and inconvenience; but where it happens that the occurrences are not recent, and there are no collateral circumſtances to aſſiſt us in identifying the parties, we muſt naturally be left in the dark. A gentleman in the Weſt-Riding of Yorkſhire, ſome years ago, felt the full weight of this defect. Being deſirous of forming a genealogical account of his family, he applied to the regiſter of the pariſh, and though he collected nearly 100 baptiſms, and as many burials in the laſt century, there was not one circumſtance that would enable him to digeſt them into any form, and to aſcertain the reſpective branch to which each party belonged. Where families of the ſame name reſide within the ſame pariſh, there will ariſe difficulties in proportion, and after the expiration of half a century it will be impoſſible to diſtinguiſh the deſcendants of one houſe from thoſe of another. There lived ſome years ago, in the neighbourhood of Thirſk, three reſpectable families, nearly allied, of the name of Kitchingman, and on examining the pariſh regiſter, I find it verifies my aſſertion.

Mr. Bigland had his eye upon theſe defects, when he obſerves, "it is of im-
"portance to every family, not excepting
"the leaſt conſiderable, to pay ſome re-
"gard to their pedigrees, and conſe-
"quently that every circumſtance, whe-
"ther of a public or private nature, that
"tends to illuſtrate genealogical intelli-
"gence, ſhould be attended to with the
"moſt religious exactneſs."

Let us then view the laſt mentioned names, regiſtered according to the form, at the end of theſe remarks. With the addition of collateral circumſtances we ſhall eaſily diſtinguiſh the object of purſuit, whether it may regard the title of our property, or only the gratification of an enquiry natural to thoſe who are deſirous of knowing whence they are deſcended. We have therefore allotted the *third column* to the name, profeſſion, and deſcent of the father, and the fourth to the name and deſcent of the mother, the particulars of which may eaſily be collected when the infant is baptized. Thus ſhall we hope, on trials of titles to eſtates, and genealogical enquiries, to raiſe a fund of intelligence to the induſtrious antiquary as well as the gentlemen of the law, and perhaps they may allow this ſcheme to bid the faireſt for ſupplying the place of viſitations or inquiſitions *poſt mortem*.

THE *fifth column* ſhews the birth, and the *ſixth* the baptiſm of the infant; the entry of each being eſſentially neceſſary. When the age bears date from the baptiſm only, the child may become ſubject to great inconvenience. Let us illuſtrate this ſuggeſtion.

A PERSON leaves 5000 l to a diſtant relation in caſe his ſon ſhould die in his minority. It ſeems, from the remembrance of creditable neighbours, that the child was certainly born a fortnight before baptiſm, that he married in his minority, and died a week under age according to the date of the baptiſm, being ſurvived by his wife and an infant ſon. The parents and witneſſes of the birth being dead, and no particulars found ſufficient to aſcertain the preciſe day of his birth, the entry of the baptiſm is admitted as evidence, and the diſtant relation poſſeſſes the fortune, to the great prejudice of a poor relict and her helpleſs child.

In pariſhes of vaſt extent, where families dwell at a great diſtance from the church, the winter floods and other accidents frequently delaying the baptiſm of the infant, it is not uncommon to ſee children brought to the font at three, four, and ſix months old; nay upon the moors, and in other remote parts, we have inſtances of children receiving baptiſm aged almoſt as many years: a moſt eſſential reaſon this, why the birth of infants ſhould be carefully regiſtered as well as the day of baptiſm. For it ſhould be conſidered, that under the age of twenty-one years, a perſon cannot marry without conſent of parents or guardians, take his freedom in any corporation, vote at an election, be a Repreſentative in Parliament, or, in ſhort, fill many important offices in ſociety: and may it not happen from a concurrence of circumſtances, that perſons really of that age may be deprived of ſuch benefits and loſe ſome great and valuable privileges? If then the entry of the birth, as well as baptiſm, will be admitted as evidence, and effectually prevent ſuch ill conſequences, what pity it is that the birth is ſo frequently omitted; It is ſomewhat remarkable that a gentleman who was almoſt the firſt perſon that did me the favour to inſpect the preſent form, and whoſe family is diſtinguiſhed for ancient reſidence upon their property in the neighbourhood, told me that his baptiſm was regiſtered at O——, but that after the ſtricteſt enquiries he never could be informed *when* he was born.

WHAT has been obſerved on the page for baptiſms, will ſerve to illuſtrate that for the burials: and as an affection for the memory of thoſe we loved prompts us to a deſire of mingling our aſhes with theirs, I have been particular in aſcertaining the place of interment.

I HAVE only to add, that the uniformity of the page has been conſulted, and that the *two laſt columns* in the regiſter of burials are intended to diſtinguiſh places remarkable for longevity or the reverſe, and to acquaint us what diſorders mankind is ſubject to under particular ſeaſons and climates; the uſe of which information is ſufficiently evinced by Doctor Percival of Mancheſter.

Should this form meet with the approbation of the public, I can claim no other merit than having improved upon a hint given to the community in the year 1715 by Mr. Thoreſby, the ingenious author of Ducatus Leodienſis, or, the Topography of Leeds, as propoſed to him by an eminent Antiquary, Thomas Kirke, Eſq. of Cookbridge, near to that town.

WILLIAM DADE.

BAPTISMS AT ST. MARY's CASTLEGATE, YORK, FOR THE YEAR 1774.

Infant's Chriſtian Name.	Infants Surname and Seniority.	Father's Name, Profeſſion, and Deſcent.	Mother's Name and Deſcent.	Born.	Baptized.
JOHN	FAIRFAX, Firſt born of	William Fairfax, of Steeton, Eſq. 3d ſon of Sir William Fairfax of Denton, Knight. By Mary, eldeſt daughter of Hugh Cholmley of Whitby, Eſquire.	Mary, only daughter of Sir Walter Bethell, of Ellerton, Knight. By Jane, daughter and coheireſs of William Sotheby, of Birdſall, Eſq.	On Monday the 24th of January.	On Sunday the 30th of January.
MARY	BECKWITH, Second daughter of	Thomas Beckwith, counſellor at law, on Friar Wall, only ſon of the late Roger Beckwith of Ripon, Gent. By Jane his ſecond wife, daughter of John Hungate, of Saxton, Eſq.	Margaret, daughter and heireſs of John Darley, of Buttercramb, Eſq. By Frances his firſt wife, daughter of John Milner, of Tadcaſter, Eſq,	On Saturday the 22d of January.	On Wedneſday the 16th of February.
JAMES	ANDERSON, Fourth Son of	John Anderſon, Apothecary, in Caſtlegate, youngeſt ſon of James Anderſon of Brigg com Linc. Gent. By Frances, daughter of William Saltmarſh, of Howden, Gent.	Sarah, late relict of William Ramſden, rector of St. Martin's in the Fields, London, and daughter of Samuel Dixon, Alderman, of Leeds, deceaſed.	On Tueſday the 22d of February.	On Saturday the 19th of March.

BURIALS at ST. MARY's, CASTLEGATE, for the Year 1774.

Chriſtian Name.	Surname.	Deſcent, Profeſſion, and Abode.	When died, and where buried.	Age.	Diſtemper.
JOHN	GRIMSTON.	Doctor of Phyſick, a married man, fourth ſon of John Grimſton, of Grimſton Garth, in Holderneſs, Eſq. By Charlotte, 2d daughter of John Wilſon, Recorder of Hull.	Died at his houſe without Monk Bar, on Sunday the 2d of January, and buried in the vault under the altar on Friday the 7th of January.	56 years.	Apoplexy.
JANE	TURNER.	Relict of Oliver Turner, of Wakefield, Gent. eldeſt daughter of the late Samuel Palmes of Naburn, Eſq By Iſabel, daughter of James Strickland, of Thornton Bridge, Gentleman.	Died at Wakefield on Tueſday the 8th, and buried on Saturday the 12th of February, in the centre of the ſouth alley.	47 years.	Pulmonary Conſumption.
JAMES	FOUNTAIN.	Batchelor, and portrait painter in Coppergate, only ſon of William Fountain of Thirſk, woollen-draper. By Jane Stonehouſe, his wife.	Died on Wedneſday the 16th, and buried on Sunday the 20th of March, in the church-yard, under the eaſt window of the chancel.	25 years.	Fever.

⁂ This improvement may be extended to the regiſter for marriages, and the form, as eſtabliſhed by an Act of Parliament, will in general allow room ſufficient for inſerting the deſcent of each party.

EXTRACT OF A LETTER TO DR. PERCIVAL FROM THE REVEREND MR. BISSELL, OF WAVERTON NEAR CHESTER.

At the beginning of the Year 1775, the Pariſh of WAVERTON near CHESTER, contained

Inhabited Houſes.	Families.	Males.	Females.	Inhabitants.
111.	116.	310.	332.	642.

From Jan. 1ſt to Dec. 31ſt 1775 incluſive there were

Chriſtenings.		Burials.	
Males	14.	Males	6.
Females.	8.	Females.	6.
	22.		12.

BURIALS IN 1775.

Days.	Sex.	Age.	Diſeaſes.
Jan. 20.	A Woman	77 Years	Aſthma.
Jan. 31.	A Girl	9 Weeks	Convulſions.
Feb. 9.	A Woman	67 Years	Dropſy.
March 6.	A Woman	87 Years	Decay of Age, and an Ulcer in the Axilla.
April 3.	A Woman	65 Years	Putrid Fever.
April 9.	A Man	45 Years	Uncertain.
April 11.	A Man	63 Years	Dropſy.

Days.	Sex.	Age.	Diſeaſe.
June 18.	A Woman	40 Years	Conſumption.
July 6.	A Boy	14Months	Small Pox with hot Regimen.
Aug. 14.	A Boy	4 Years	Small Pox and Worms.
Nov. 11.	A Man	65 Years	Gout and Dropſy in Conſequence of hard drinking.
Nov. 26.	A Man	68 Years	Dropſy.

AN ACCOUNT OF THE BURIALS AND CHRISTENINGS IN THE PARISH OF ASHTON-UNDER-LINE, DURING THE LAST ELEVEN YEARS: COMMUNICATED BY THE REVEREND MR. CRADOCK.

BURIALS.

		Males unmarried.	Females Do.	Husbands.	Wives.	Widowers.	Widows.
1765	159	60	51	10	17	13	8
1766	187	42	54	34	24	7	26
1767	159	44	45	23	21	9	17
1768	197	69	60	18	25	1	24
1769	206	79	75	16	12	9	15
1770	167	54	46	29	7	20	11
1771	178	67	43	26	23	8	11
1772	250	97	71	16	35	10	21
1773	157	48	50	18	23	6	12
1774	152	38	46	21	24	10	13
1775	241	92	96	15	20	8	10
	2053	690	637	226	231	101	168

CHRISTENINGS.

	Males.	Females.
1765	121	114
1766	97	123
1767	116	111
1768	122	108
1769	157	137
1770	139	142
1771	133	143
1772	168	141
1773	174	131
1774	137	146
1775	168	164
	1532	1460

ADDITIONAL OBSERVATIONS ON THE EFFECTS OF FIXED AIR, IN PROMOTING THE GROWTH OF PLANTS.

I HAVE communicated, to many of my friends, an account of the experiments, which I made in the Spring of 1775, on Vegetation, as influenced by Fixed Air. And I flatter myſelf that the ſubject will engage the attention, and excite the trials of thoſe, who have a taſte for purſuits of this nature. Mr. Bew, who was a witneſs to the flouriſhing ſtate of my Sprigs of Mint, growing in Mephitic Water, has lately tried a ſimilar experiment with two Hyacinths. And I ſhall lay before the reader his account of the ſucceſs of it.

“ December 2d, 1775. Two Hyacinth bulbs, each weighing four “ drachms and a few grains, were placed “ in glaſſes made for the purpoſe of vegetating bulbous roots. One glaſs “ was ſupplied with ſeven ounces and a “ half of pump water, impregnated with “ fixed air; the other with the ſame “ quantity of rain water.

“ NEITHER of the plants had made “ much progreſs in vegetation. Some “ white fibrous roots were ſhooting from “ the plant ſupplied with rain water, “ but none from that which had the “ water with fixed air.

“ December 17th. SEVERAL beautiful white fibres were diſcovered, ſhoot-

" ing from the root ſupplied with fixed " air; and both plants were beginning " to vegetate.

" The bulb ſupplied with rain water " ſeemed, at firſt, to make the greater " progreſs in vegetation. The fibrous " roots of the other were, however, " much ſtronger, whiter, and more " tranſparent.

" They were conſtantly ſupplied with " their reſpective kinds of water; and " at intervals, when I concluded that " the factitious air was exhauſted by the " plant, the whole was poured off; and " each glaſs filled, at the ſame time, " with the ſame quantity of its proper " water.

" January 1ſt, 1776. The plant " immerſed in the water impregnated " with fixed air, ſurpaſſed the other in " the ſtrength and colour of its leaves,

" which were of a lively green, and the
" roots of a moſt beautiful tranſparent
" white. The other plant, though apparently healthy, had very few roots.

" January 16th. BOTH plants continued to vegetate, but the one ſupplied
" with fixed air much more than the
" other. And it ſeemed equally forward
" with ſome other bulbs, which had been
" placed in common rain water near a
" month before. An accident, however,
" happened at this time, which, I apprehended, would have put an end to
" my experiment. My ſervant, in letting down a large curtain before the
" window where theſe glaſſes were
" placed, overturned that which contained the water with fixed air. The
" night was rather ſevere, and the plant
" lay ten or eleven hours out of water.
" I replaced it in another glaſs with the
" mephitic water, and continued to ſupply them as uſual.

“ January 21ſt. I WAS much ſur-
“ priſed to find the plant had recovered
“ its former vigour, and was advancing
“ a ſtem with buds for flowering, which
“ the other plant ſhewed no ſigns of.

“ THE weather at this time became
“ ſo cold, that I thought it neceſſary to
“ remove all the plants out of the win-
“ dow of my parlour to a warmer part
“ of the room, that the progreſs of their
“ vegetation might not be retarded.

“ February 6th. THE glaſſes were
“ replaced in the window, and each
“ ſeemed in a very healthy ſtate. That
“ ſupplied with mephitic water, viſibly
“ increaſed every day.

“ THE plant in the rain water had
“ advanced a ſtem with buds; but not
“ more than half the ſize of the other.

“ February 27th. THE Hyacinth,

" which had been ſupplied with water " impregnated with fixed air, was in full " blow, appeared remarkably ſtrong, and " diffuſed the delicate fragrance peculiar " to the flower. It meaſured, from the " bulb, full ſixteen inches. I withdrew " it gently from the water, and found it " weighed two ounces, two drachms, " and five grains.

" The other Hyacinth was juſt beginning " to expand its flower. It meaſured " no more than ten inches from the " bulb; and though freſh and vigorous, " weighed only one ounce, one drachm, " and ſix grains."

This experiment of Mr. Bew would have been more deciſive, if he had employed rain water impregnated with fixed air, and not pump water. But it coincides with the trials which I have related, and ſufficiently evinces the powerful influence of this principle on vegetation.

It is a common cuſtom with gardeners to expoſe pump water to the ſun and air, to ſoften it, many hours before they uſe it for the purpoſe of ſprinkling their plants and flowers. This ſhould ſeem to be an injudicious practice, if the hardneſs of the water ariſe, as it often does, from the fixed air which it contains. For it will thus be deprived of that conſtituent part, which has been ſhewn to be ſo friendly to vegetable life. Mephitic air is found in many common ſprings; and ſuch ſhould always be ſelected for the uſes of gardening and agriculture. In green houſes, water artificially impregnated might be employed, without any great trouble or expence.

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E R R A T A.

In ſeveral places for phœnomenon *read* phænomenon.

Page	146,	Line 3,	*for* mephitic air *read* mephitic water.
	147,	3,	*ibid.*
	165,	18,	*for* heterogeneus *read* heterogeneous.
	298,	12,	*for* and ſtimulating *read* and leſs ſtimulating.
	303,	6,	*after* both *read* the.
	314,	4,	*for* calculus *read* calculous.
	322,		Dr. Saunders' ſecond letter paſſim, *for* Lythargyrites *read* Lithargyrites.
	325,	21,	*for* vitriolic *read* vitriolum.

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